DATAMATION 58

FEATURES

ARTICLES

the automatic handling of information

volume 4, number **3**

DEPARTMENTS

On the Cover: Counter sums in the engineering prototype of the NCR 304 system's central processor.

OVER 23,000 CIRCULATION

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DATAMATION *in business and science*

PHILCO, L&N WILL PLAN NEW COMPUTER

Philco Corporation and Leeds & Northrup Company have launched a shared cost program to develop, design and build a digital computer which will have important applications in industrial process control and in scientific and engineering computation, including data processing. Development work is already under way, with field trials of a prototype computer system set for next year.

Through its nation-wide marketing and service organization, L&N plans to utilize the unit as an integral part of industrial control systems of advanced scope. Philco will make the computer available for scientific and engineering computation, the acquisition and processing of data, and for real time control for military systems and other commercial equipment.

JENKINSON LAUDS EQUIPMENT INDUSTRY

Mechanical, electronic, and electromechanical devices to convert data into a language computers can understand have brought "astounding progress" in the field of automatic data processing. So says George H. Jenkinson, a specialist in systems engineering at Battelle Memorial Institute, Columbus. Writing in the April issue of the BATTELLE TECHNICAL REVIEW, Jenkinson points out that the growth of the industry producing this auxiliary data-handling equipment has equalled the growth of the computer industry itself. "Everyone is familiar with the expression 'necessity is the mother of invention,' and it would be difficult to imagine any field where this is more evident than in the evolution of today's auxiliary devices for computers," he wrote.

CEC SALES DOWN BUT RESEARCH REASSURING

First quarter sales of Consolidated Electrodynamics Corporation, Pasadena, were $6,986,000, up slightly from 1957 first quarter sales of $6,821,000, states Philip S. Fogg, board chairman. Despite this increase in sales, the company lost $56,000 during the three months. Fogg attributed the loss in part to continued heavy expenditures in research and development activities, particularly in the Datalab division's new advanced airborne data processing instrumentation.

But the company's investment in this area seems to be paying off. CEC will soon begin to deliver the above-mentioned instrumentation to Douglas Aircraft Co. for the flight-test program of that firm's DC-8 jet airliners. The total contract, for development and manufacture of the digital recording and magnetic tape equipment, exceeds $2,250,000.

COMPETITORS RALLY 'ROUND COMPUTER

Seven downstate Illinois engineering firms, all of them competitors, have formed a unique corporation around a Bendix G-15D computer, which, they state, allows them not only to continue as competitors but also to give stiffer competition to larger firms. The organization is the Midwest Computer Service, Inc. and it began operations in April.

"This is our answer to the serious problem of the small engineering firm not able to afford even the lowest cost computer," explained E. M. Chastain, president of Midwest. "But the need for a computer is so great it's a matter of get one or get out of the race."

MARE ISLAND INSTALLS FIRST COMPUTER

At Mare Island Naval Shipyard in Vallejo, Calif., an IBM 705 was installed in March and is now the first computer to operate in any U. S. naval shipyard. It is being used to assist shipyard officials in nearly every phase of the yard's complex $80,000,000-a-year operation. Rear Adm. Martin J. Lawrence, Shipyard Commander, states that the data processing system will also be used to coordinate and speed construction of the new Polaris missile-launching submarine being constructed at the yard.

ANALOG ⇨ DIGITAL CONVERTERS: AN EVALUATION

by DR. MARTIN J. KLEIN
Director of Research
Cohu Electronics, Inc.

It is difficult to imagine a field of endeavor in the electronics industry which is receiving more attention than analog–digital converters. About five years ago the first steps of a few companies into the field of analog–digital converters was begun. Today, it is hard not to find an electronics company which either has under development or is considering developing a converter of some sort. It is interesting to examine why this has occurred.

The necessity for the analog-digital converter has come about by the widespread usage of electronic digital computing machines. In the field of measurement, it is an unfortunate fact that most of the devices which convert information into an electrical signal (the transducer) are essentially analog devices. That is, they put out a voltage which is proportionate to the phenomenon whether it be pressure, displacement, or acceleration. The digital computer, on the other hand, requires precise electrical quantities representing numbers.

These are ordinarily presented in some form of code, binary code being the most familiar. The analog output of instruments and the digital requirement of computers is incompatible. Therefore, some device is needed which will make the two operable with each other. This is the essential purpose of the analog-digital converter. In this role, it has found extensive use in the wide application of digital data systems which are being designed and built today. Because of the extensive number of points being used in tests, it is almost impossible for human labor to reduce the graphs to usable form and numbers.

As a consequence, an electronic digital computer is used for this purpose. This in turn gives rise to the analog-digital converter as a connecting link between the analog transistor and the computer itself. As the interest in logging large quantities of data increases, the use of the electronic digital computer and the analog-digital converter will simultaneously increase.

It is surprising, however, that the original purpose for the analog-digital converter was somewhat far removed from data logging. Communications engineers are well acquainted with the fact that for a given output power, noise can be overcome if the bandwidth over which the signal is sent can be expanded beyond its normal requirement. FM radio was the first of such an attempt to extend the bandwidth beyond its necessary limits in transmitting information. However, PCM (which stands for pulse code modulation) puts at the disposal of the communications engineer a technique by which he can expand the bandwidth very simply, electronically. Here again, the analog voltage can be converted into definitive pulses representing numbers and by techniques as "redundancy coding" the bandwidth can be extended to any degree desired.

Considerable work was done on this in the late '40's in an effort to transmit television signals in pulse code modulation, thus rendering the picture immune to all noise interference at the home receiver. As a practical matter, the analog-digital converter in this application has not even begun to be effective. We can expect, in the constant battle to overcome noise, that eventually this will be one of the largest uses for an analog-digital converter.

The two principle uses then for an analog-digital converter are in data logging systems involving large quantities of data and as such a technique for overcoming noise in the transmission environment.

Generally speaking, analog-digital converters are expensive and very often their use is not justified. One other possible justification is that analog-digital converters give the readings in direct arabic numericals, thus eliminating and avoiding the possibility of human error in reading scales or curves.

Classifications of Converters

Specifications for analog-digital converters are: 1—electro-mechanical converters, and 2—all electronic converters.

Electro-mechanical converters are self-explanatory. This means that in the process of converting an analog voltage into a digital value, electro-mechanical devices such as relays, turning wheels, moveable potentiometers, and other hybrid devices are used. An all electronic converter has no moving parts whatsoever. As a rule of thumb, electro-mechanical converters require one-half to two seconds to make a conversion whereas all electronic converters can make a conversion in the order of a few microseconds if required.

A given converter can be classified according to its performance in the following way:

conversion rate

Conversion rate is the number of complete conversions made in one second. That is, how many times per second the converter gives a number representing the analog voltage.

quantizing error

In the process of converting an analog voltage into numbers, the converter introduces a certain uncertainty. This is because a continuous voltage is infinite in its number of increments while any converter only has a fixed number of increments. It is unable to determine the voltage within a given increment.

conversion accuracy

The conversion accuracy is defined as the number of distinct steps that the converter can sense linearly. A converter which is capable of reading from 0 to 999 with 1000 equal incremental analog voltages is said to be good to 0.1%. A converter which can read 100 equal increments from 0 to 99 is said to be good to 1.0%.

bit rate

The bit rate is defined as the rate at which a single bit

ANALOG-DIGITAL CONVERTERS

is generated. Many converters proceed through binary code. A 0.1% converter requires 10 bits to represent 0 to 999 in binary code. If it makes a complete conversion in one/hundredth of a second, the bit rate would be one/tenth of this or one milisecond.

Generally speaking, the faster the conversion rate, the more difficult it is to obtain accuracy. The two requirements are working against each other. Electro-mechanical converters can make a complete conversion in from one to five seconds. All electronic converters can make a conversion in the order of one microsecond, if required. Electro-mechanical converters can convert with an accuracy of 0.01%. A one microsecond electronic converter can make its conversion with an accuracy of about one per cent. Generally, the slower the conversion rate the higher the accuracy that can be obtained to a limit of 0.01%.

It is necessary to examine how converters operate to be able to compare their performance. Generally speaking, they operate on one of three principles: time encoding, trial encoding and spatial encoding.

Let us examine these one by one. Figure 1 shows a simplified block diagram of a time encoder. In this type of encoding a clock operates through a gate into a counter which accumulates the clock counts. At the beginning of the conversion, the gate is opened allowing the clock pulses to feed the counter. At the same time a linear sweep generator is triggered generating a highly linear sweep between an upper limit and a lower limit, both of which are precisely established. This sweep voltage is fed to one side of a difference amplifier and the analog voltage to be converted to the other. When the two are exactly equal, an output pulse closes the gate. The count standing in the counter is thus the digital representation of the analog voltage being encoded. Ordinarily, one normalizes the output count. That is, the clock rate is set so that a full scale count is attained in the interval of the linear sweep.

The advantage of this type of encoding is that it is relatively simple to build, providing that the conversion rate does not exceed one thousand per second using all electronic techniques. The accuracy of the system is limited by the linearity of the sweep and sweeps of 0.05% between two well established limits are readily possible. The disadvantages of such a converter are that the time to make a conversion depends upon the analog voltage being converted itself. If the voltage is high, a conversion is made almost at the start of the sweep, whereas if the voltage being converted is low, the sweep must progress from its upper extreme almost to the bottom of its excursion before the conversion is made. This can be somewhat overcome by recognizing that the conversion count is essentially a measure of time itself. It should be noted that the converter is giving the instantaneous value of the sweep compared with the input voltage so that variations of the input voltage will not effect the sweep.

A trial voltage encoder is somewhat simpler in concept,

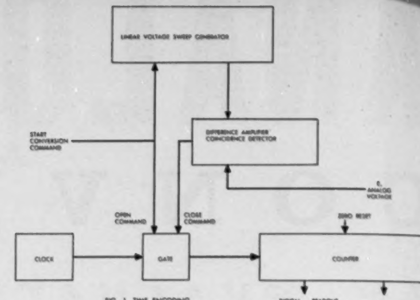


FIG. 1 TIME ENCODING

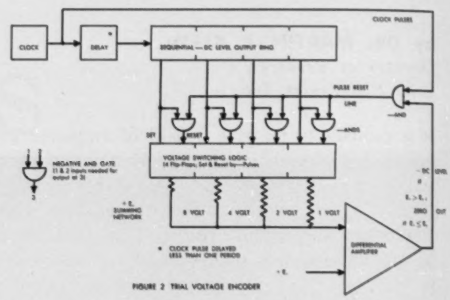


FIGURE 2 TRIAL VOLTAGE ENCODER

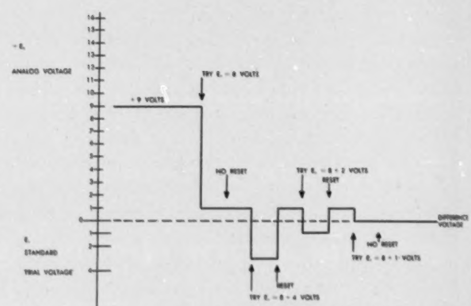


FIGURE 3 DIFFERENCE VOLTAGES GENERATED BY LOGIC TRIALS

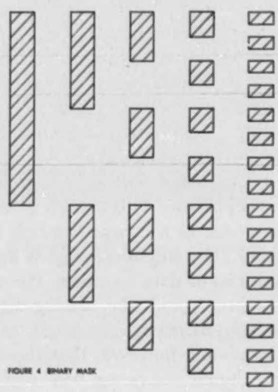
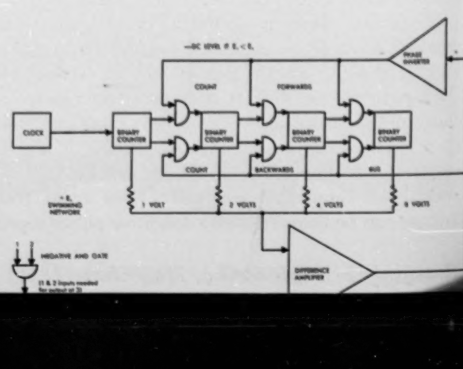


FIGURE 4 BINARY MASK



but actually more difficult to construct. A trial voltage encoder is shown in the simplified block diagram number 2. A difference amplifier is fed with two voltages—one, the analog voltage being converted, the other input, a fed back voltage. This fed back voltage is generated within the converter itself, this part sometimes being known as a DAC or digital analog converter. The two are connected by a logical network. The operation of this converter is shown in Figure 3. Suppose that the full scale voltage in the system is chosen as 16 volts. Suppose further that we require only an accuracy of one part in sixteen or 6%. We would arrange the DAC to generate successive voltages of 8, 4, 2, and 1 volt. At the beginning of the cycle, a clock and ring circuit turn on the 8 volt generator. The 8 volts is fed to one side of the differential amplifier, which is also receiving the 9 volts analog signal to be converted. The logic is arranged so that if the analog voltage is greater, the output trigger is + and the trial voltage continues to be locked in.

This is the case on the first trial voltage and the 8 volts stay locked in. At the next step in the conversion the second trial voltage, 4 volts, is added to it giving a total of 12 volts fed back as compared with 9 volts analog signal. This exceeds the analog voltage, and the logic throws out the last bit leaving a net of 8 volts fed back. This also happens on the third trial voltage, 2 volts, but on the fourth trial voltage, the one volt remains the same, or locked in. By sensing the state of the locked in voltages, we would find that 8 and 1 remain in, and 4 and 2 have been thrown out. In binary code this could be represented as 1001 which is the binary representation of 9.

The advantage of this type of converter is that a conversion is made in a fixed and precise interval of time irrespective of the magnitude of the voltage being converted. It is also in essence the fastest way of making a precision conversion. Converters operating to 100 kc conversion rate have been built using these techniques. Accuracies of 0.1% are not difficult to obtain.

The third type of converter, the spatial encoder, is illustrated in Figure 4. This figure represents what is called binary mask. That is, if we read across from left to right at any heighth on the mask we will have a binary output corresponding to the heighth. A transparent mask made in exactly this way can be placed on the front of an oscilloscope. The analog voltage is connected to the vertial deflection plates. At each sweep the beam will move from left to right across the mask corresponding to the magnitude of the analog voltage. The black and white light output can be sensed with a photocell thus giving a pulse representation in binary code of the analog voltage. Such a converter can be made to operate at very high speed using a photo multiplier tube. However, the linearity and accuracy are limited by the oscilloscope and beam width itself. However, accuracies of 0.5% are readily obtainable with such a technique and conversions in excess of 1,000,000 per second are not difficult to obtain. This technique has not been widely exploited except experimentally.

A fourth type of all electronic and electrical mechanical converter can be constructed from a combination of principles of the trial encoder and time encoder. Figure 5 is a simplified block diagram of the essential parts of such a converter. It consists of a differential amplifier the output of which is connected to a forward and rearward bus. These buses electronically reverse the connections between the counters, thus causing them to count up or down in spite of the fact that the clock pulses enter from the same end always. The counters in turn generate trial voltages much like in the trial encoder.

These trial voltages are fed back to the differential amplifier. When the trial voltage fed back is equal to the analog voltage, the buses are both inactive and no count can be fed through to the counters. Let us go through a cycle of operation in such a converter. Let us assume that at the start of the cycle there is no count on the counters. Let the analog voltage be four volts. When the gate is opened the fed back voltage is 0 and on the first clock pulse a single count enters to the counter thus generating one volt. Because the trial voltage exceeds the fed back voltage, the forward bus opens and the counters are connected so that they will count upward. The second clock pulse will generate two volts, the third three volts, and finally four volts at which point the buses close. The count standing on the counters is thus the conversion.

Now let the next voltage be two volts. Because the analog voltage is less than the fed back voltage, four volts, standing the counters, the rearward bus opens. The first count thus makes the count go down one and the fed back voltage is now three volts. The second clock pulse generates two volts and finally the buses close. Thus, the counters can be made to count up or down.

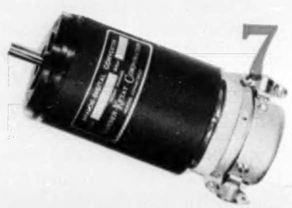
State of the Art

Probably the most fruitful area for analog-digital converters lies in the transducers themselves. Surprisingly, little or no work has been done in this direction. The only transducer approximating a digital output is shown in Figure 6. This is the vibration pressure transducer. It provides

Vibrotron Digital Pressure Transducer, BJ Electronics

digital output in the form of a varying frequency. This transducer is essentially analog in type, except that it mechanically converts into a digital output by virtue of a membrane changing the frequency of a vibrating reed.

Presented on page nine is a fairly complete list of the various manufacturers engaged in designing and building



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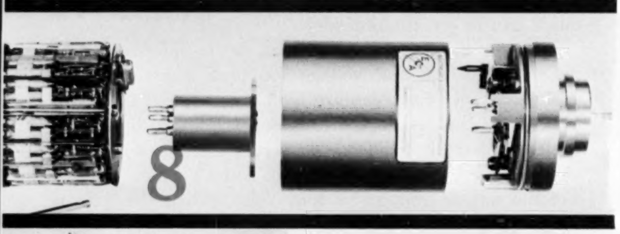

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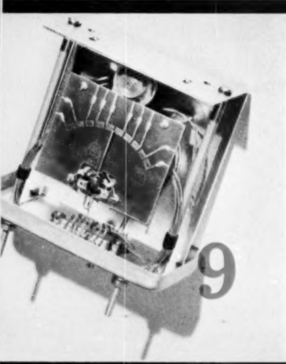

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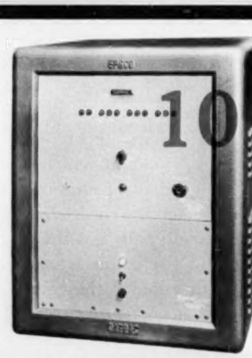

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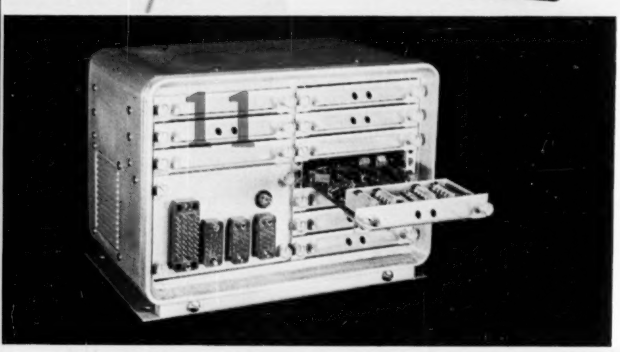

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analog digital converters of the various types. The breakdown is according to the classifications previously given. A brief description of the method of accomplishing conversion is implied in the classification by manufacturers.

Figure 7 shows the NORDEN-KETAY ENCODER. This encoder uses brushes on seven bit coded disks. One disk gives 128 counts per revolution. At the operating speed of 200 RPM, the total count is 425 per second. A complete total count of two to the thirteenth power is obtained by gearing two disks through a 64-1 gear ratio. This unit is representative of the many spatial coded disk converters. Generally, they have, by virtue of mechanical gearing, very high resolutions and accuracy.

Another form of substantially the same type of converter is shown in Figure 8. This converter is manufactured by ELECTRONICS CORPORATION OF AMERICA. It has no contacts between the wheel and the sensing element. In this converter the wheel is turned through suitable gearing and a beam of light is fed through a transparent code wheel. The output is sensed with a multi element PbS (lead sulphids) cell. Thirteen digits are possible with one four inch diameter code wheel.

Figure 9 shows a low current analog to digital converter known as "LIAD" made by ASSEMBLY PRODUCTS, INCORPORATED. In this product a d'Arsonval movement deflects a moving contact across a code arc. The output is fed through the contact thus giving a digital output. The contact is not made until a pusher bar presses the pointer against the dial plate making contacts on the coded arc to give the digitized output. This is one of the fastest electromechanical converters giving two conversions per second with an accuracy of two percent.

There are many manufacturers in the high speed all electronic digital converter field. One of these is the DATRAC B manufactured by EPSCO, INC. This converter is shown in Figure 10. Its operation is substantially the one of the trial voltage encoder. Its manufacturer claims up to 50,000 conversions per second at an accuracy of 0.1%. A similar converter is manufactured by RADIATION, INC., Figure 11, for airborne use.

Figure 12 is a multi-meter manufactured by KIN TEL CORPORATION. This converter will make up to 100 conversions per second with an accuracy of 0.1%. It is designed primarily as a laboratory or production control instrument and gives a clear visual readout. A conversion is accomplished by the trial voltage technique discussed similar to the EPSCO and RADIATION, INC. instruments.

These are samples of the many shown in the table. At the present time, there are innumerable other manufacturers with converter programs under development or consideration. During the next two or three years, we can expect to see a considerable number of these available on the market.

Present activity in the field indicates that many of these will soon be available in transistor form principally because

Time Encoding

Electro Mechanical:

- Kybernetics Company

Electronic:

- Consolidated Electrodynamics, Corp.
- Franklin Electronics, Inc.
- Ransom Research
- Weston Electrical Instruments

Trial Encoding

Electro Mechanical:

- Cubic Corporation
- Electro Instruments
- KIN TEL, Division of Cohu Electronics, Inc.
- Non-Linear Systems, Inc.

Electronic:

- American Machine & Foundry Company
- Beckman Instruments, Inc.
- Epsco, Inc.
- KIN TEL, Division of Cohu Electronics, Inc.
- Minneapolis-Honeywell Regulator Company
- Packard-Bell Computer Corp.
- Radiation, Inc.
- J. B. Rea Corp.

Space Encoders

Electro-Mechanical:

- Assembly Products, Inc.
- Baldwin Piano
- Benson-Lehner Corp.
- Consolidated Electrodynamics, Corp.
- Coleman Engineering Company
- Electro-Mec Laboratory, Inc.
- Electronic Corporation of America
- Farrand Controls, Inc.
- Fischer & Porter Company
- G. H. Giannini & Company, Inc.
- W. & L. K. Gurley
- Jacobs Instrument Company
- Kearfott Company, Inc.
- Librascope, Inc.
- Norden-Ketay Corp.
- Streeter-Amet Company
- Taller & Cooper, Inc.
- Telecomputing Corp.
- Wang Laboratories, Inc.

Electronic:

- Bell Laboratories
- U. S. Army Signal Engineering Labs.

of the advantage of using this converter for telemetering data in PCM. As was noted at the beginning of this article, this allows one to overcome noise on the effects of the signal to a considerable extent.

What to Do With Them

The analog-digital converter is hardly the answer to all problems in data logging or PCM telemetry. The problem is somewhat aggravated by the fact that ultimately these tapes will have to be read into a computing machine, in order to take any advantage of the time to be saved. Computing machines vary considerably in the language on tape, that is, the format of the data. Thus each installation of an analog-digital converter is virtually a custom operation. If one changes the computer to which the data is to be put, one is forced to change the entire format on the tape.

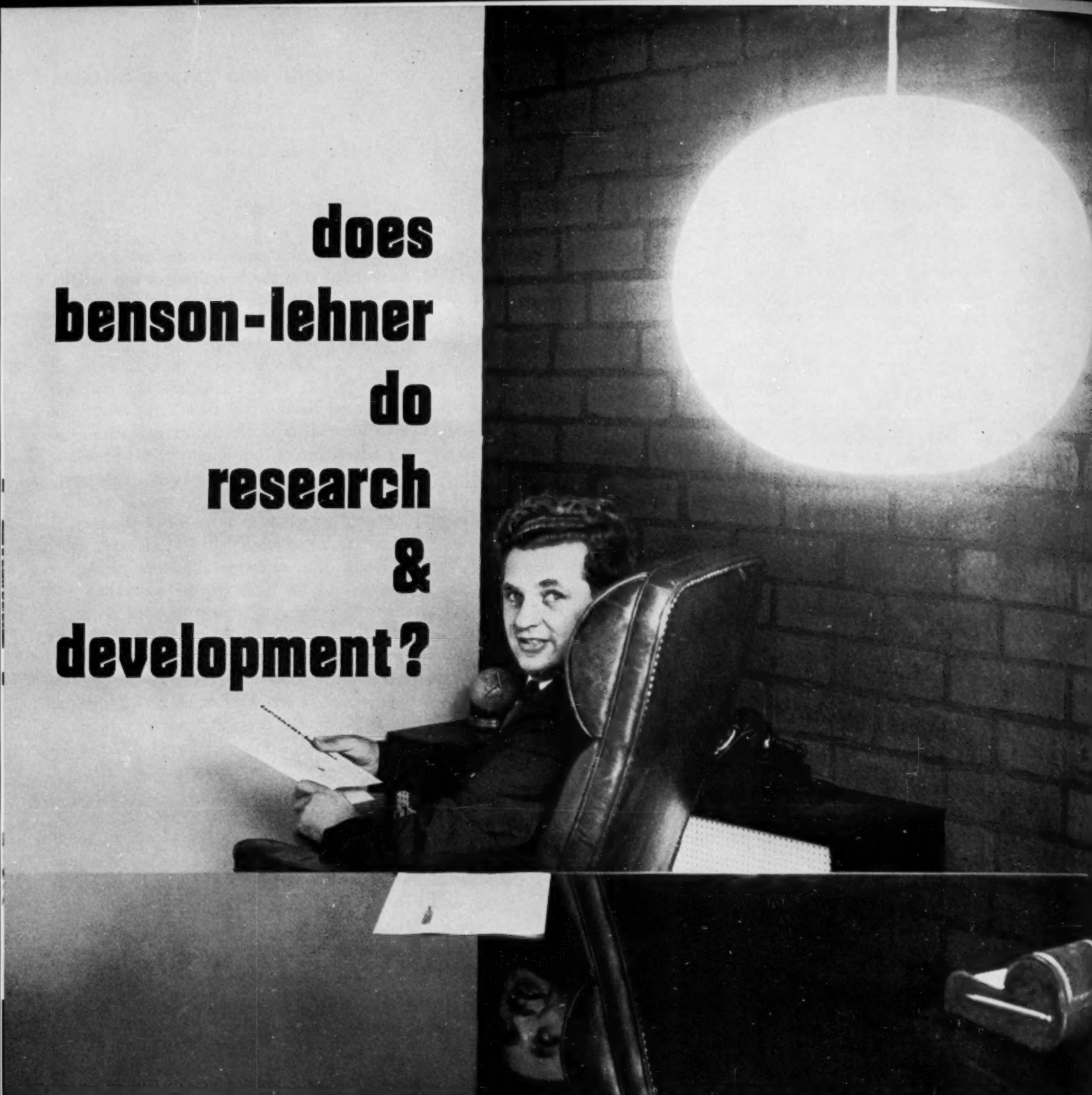
Ordinarily, because of the high cost of converters one must time share it with many channels of data. This requires some sort of switching of the input. In general, high speed switching devices are only at their beginning. One finally develops a large system with a considerable number of electronic elements all of which must be keyed together and must be made operative. Very few of these systems have been built and operated for any period of time. Indeed, there is hardly enough experience to actually tell whether a genuine saving will be affected.

It is somewhat surprising that the area to which analog digital converters lend themselves has been least exploited. This is the process industry. In process industries the phenomenom varies slowly and therefore relatively slow converters and switches can be seen. The techniques are definitely within the state of the art. And yet, one finds very little interest in this type of system in the process industries themselves.

It can be expected that it will take five to ten years until they establish themselves in this very applicable area. The area in which there is most intense development is in the high speed converter field. It is questionable whether the interest is justified in the final analysis. One place that converters do not lend themselves is to where only a small amount of data is to be taken. In the case that small amounts of data are to be taken and precision is required, the human operator can almost universally accomplish the task much more easily.

In conclusion, then, we can say that the analog-digital converter is under very intensive development. It appears that there will be no more major changes during the next five years in the basic techniques used, but merely refinements. A high degree of solid state design can be expected.

Generally speaking, a cost saving can only be effected where a tremendous amount of data is genuinely needed. It should also be remembered that the converter represents a small fraction of the total cost of a data logging system. In the area of telemetry the converter will ultimately find wide use. This is still some years away because most telemetry ground stations are committed to existing frequency multiplexing techniques.



Bernard S. Benson, President of Benson-Lehner Corporation

We certainly do! In fact our company's growth, including all our products, is based on buying R & D talent from the best source we could find—OURSELVES. To say the least, the results have been rather satisfactory. We believe in using our heads before we use our hands, and work to deduce optimum solutions by a process of logic rather than trial and error. With a history of success in R & D, we are now expanding these facilities, working with both Government and industry. We are deeply involved with work in data acquisition, storage, translation, retrieval (or more accurately, data banking), displays, and other areas. If you are interested in both speed and direction in R & D, you are probably interested in Benson-Lehner Corporation, 11930 Olympic Boulevard, Los Angeles 64, California.

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DATAMATION *abroad*

COMPUTER CENTERS SET UP IN WEST GERMANY

Leading industrial firms in West Germany have begun setting up their own computing centers. One of the first, the Allgemeine Elektrictats-Gesellschaft (AEG) has opened a Berlin center built around an IBM 650. Engineers and mathematicians, specially trained in programming techniques, are computing problems primarily of an engineering nature at present, although industrial problems are also being introduced. As a supplement to the Berlin center, AEG has set up a smaller center in Frankfurt in their Institute for Automation. This smaller center has a Telefunken analog computer as its main unit.

JAPANESE FIRMS ORGANIZE: PUSH COMPUTERS

A central organization for the development of the electronic industry in Japan, a group of companies to be known as the Electronic Industry Development Association, will be inaugurated shortly with a government subsidy. Four firms, Hitachi Works, Tokyo Shibaura Electric, Japan Electric and Yokokawa Electric Works are making initial preparations. Forty-one companies are expected to join. Among the main objectives of the organization—to install a computer service and to train programmers. . . . Also in Tokyo, Japan's only existing computer service (180-word free memory relay computer) is now operating around the clock. To catch up with an increasing work load, Yurin Electric Co. installed a second 60-word computer in April and plans installation of a third next year. The 180-word unit was placed in service as a commercial demonstrator last November by Yurin, representative for Fiji Electronic, the computer's manufacturer. At a $25-per-hour fee, the present rate of use has produced a gross income almost equalling the unit's $125,000 selling price. The forecast section of Japan's Meteorological Agency was one of the first to use the service—to predict typhoon tracks. Accurate, 24-hour advance typhoon forecasts resulted and the agency now plans to purchase its own computer.

LONDON SITE OF EXHIBITION, SYMPOSIUM

More than 40 British manufacturers of electronic computers and components will take part in a Computer Exhibition and Business Symposium in London from November 28 to December 4. The symposium will stress the value of the computer as an aid to management and will consist of papers designed to present up-to-date information concerning installation and operation of computers and data processing systems. Applications to general business management, such as payrolls and stores control for railways, steel works, farms, and motor sales companies will be included. Organizers are the National Research Development Corporation, the Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association. Further information is obtainable from Exhibition Organizer, 11/13 Dowgate Hill, London, E.C. 4.

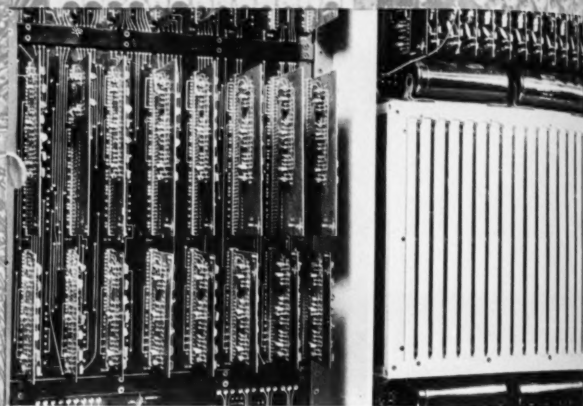
IN ZURICH— SMALLEST TRANSISTOR?

What is reported to be the smallest commercially-produced transistor, the OC 57, has come off production runs at the Zurich factory of Swiss Philips AG. The first transistor to be completely developed and produced in Switzerland is the work of engineer Franz Winiger. The OC 57 measures 5/32 in. in length and 1/8 in. in diameter.

BRITISH JOURNAL COVERS COMPUTER FIELD

First copies of Britain's first magazine devoted to computers and data processing were released in April. The COMPUTER JOURNAL, to be issued quarterly, is published by the British Computer Society Limited. DATAMATION wishes its British counterpart good luck and good coverage.

304



Vital to the central processor of the National 304 system engineering prototype is this 2000-word memory and associated circuitry.

The National 304 Electronic Data Processing System, a fully transistorized system designed expressly for processing business data, is now entering production. It is the first wholly business-designed large-scale system featuring all solid-state circuitry. A minimum system sells for approximately $800,000.

Development work was done in the National Cash Register Companys' Electronics Division in Hawthorne, California, and at the main NCR plant in Dayton, Ohio. A complete prototype of this system is undergoing final systems and reliability tests at the Hawthorne facility. Production is now beginning at the NCR plant in Dayton and at the General Electric Co. Computer Department in Phoenix, Arizona. The G-E plant is manufacturing five of the system's twelve units, including the central processor for NCR.

Features of the system include: a "business command structure," which enables the programmer to write instructions in simplified language; automatic checking throughout the entire system to assure accurate transmissions; a universal converter which permits all input-output functions to be time-shared with the processor; high-speed input and output units; full transistorization; plug-in card circuitry; high-speed magnetic core memory; and printed circuitry.

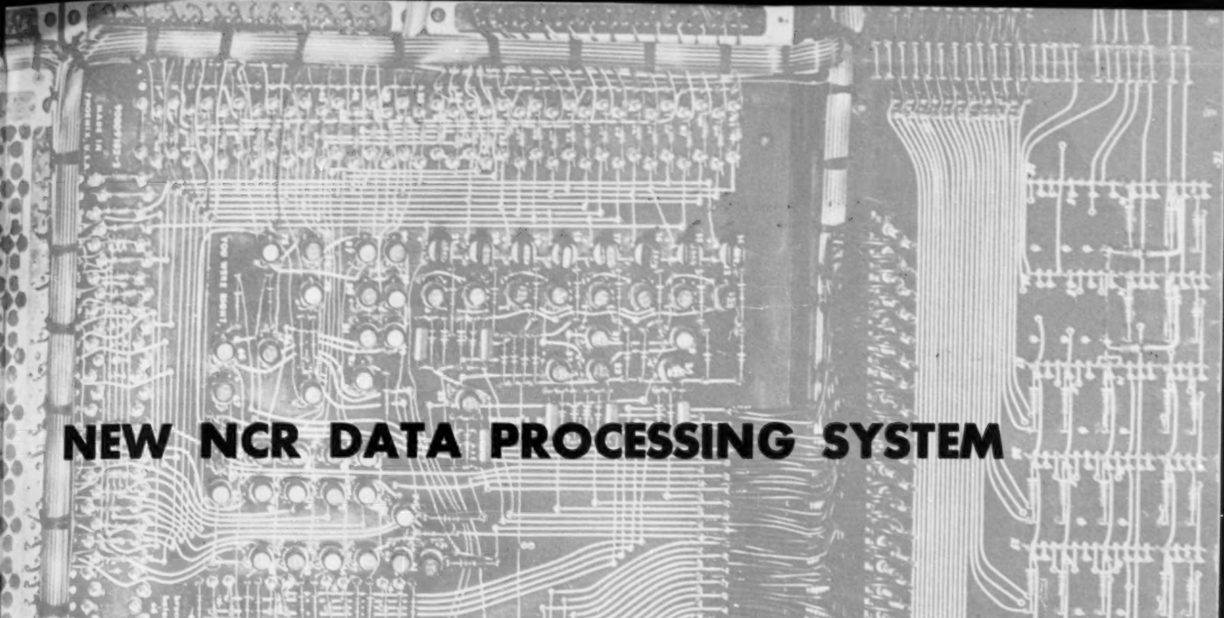
The system is alpha numeric, providing 10-character words and a basic 2000-word magnetic core memory (4000-word memory available). Ferrite cores used in the main memory were also developed by NCR.

Six 304 systems have been ordered to date. NCR plans its first delivery for mid-1959. S. C. Johnson Co., manufacturer of wax and other household products, will use a 304 system for warehouse control, inventory and billing. The company will tie the equipment in with a nationwide communications network which covers all sales offices and warehouses. It is anticipated that the 304 will help the company keep records on all of its products, thereby solving complex warehouse problems, cutting operating expenses and providing improved service to customers. American United Life Insurance Company plans to use a 304 system for premium billing and actuarial calculations. Because the firm handles much of its business on a reinsuring, or farm-out basis, paper processing work is extensive. General Tire & Rubber Company has ordered a 304 for billing and order control, and the U.S. Marine Corps has selected the system for personnel accounting. Some manufacturing companies ordering the new equipment indicate that the system will be utilized in all areas of company operations, from warehouse control to raw stock ordering.

All equipment in the system was created especially for business data-processing functions, with the intent that each unit should contribute proportionately to total system efficiency. No attempt was made to "build around" existing machinery. While the 304 engineering program began late in 1954, the Electronics Division altered the course of development significantly in September, 1955, by deciding to transistorize what had originally been planned as vacuum-tube equipment. The basic pulse rate of 400 kc permits the use of presently available transistors of proved reliability. Besides increasing overall dependability, the solid-state circuitry of the 304 lessens power demand and lowers heat output.

Reliability Top Engineering Objective

The greatest single objective of NCR engineers in creating the new system was reliability. This consideration weighed heavily in the company's decision to design using only solid state components in 304 equipment. Design



NEW NCR DATA PROCESSING SYSTEM

tolerances are set beyond those of "worst case" conditions of heat, voltage fluctuation and aging. The logic is built largely from standardized plug-in card circuits.

Printed circuitry has eliminated almost all hand wiring. As a result, production quality control is kept uniform. Check-out and maintenance are simplified by the system's unitized construction. Each unit is separately powered and contains circuitry which performs a sequence of automatic reliability tests. These tests will isolate the area of a malfunctioning circuit. A service man can then replace the circuit quickly with a new plug-in assembly.

System Components

Twelve units make up the complete 304 system: computer, console, magnetic tape controller, magnetic handler, paper tape reader, card reader, paper tape punch, high-speed printer, printer buffer, typewriter printer, printer converter and universal converter. Individual packaging of these components makes the system highly flexible, and permits continuing expansion.

High-speed input-output units include a paper tape reader which reads 1300 characters per second and feeds directly into the processor, or converts to magnetic tape independently of the processor; a card reader which reads 1000 cards per minute and feeds directly to processor or converts to magnetic tape; a magnetic tape handler which writes and reads 20,000 characters per second; a printer which operates at 600 lines per minute and offers line-skipping speed of 4200 lines per minute; and a 60-character-per-second paper tape punch.

Provision has been made in the original design for connecting additional units to various components. Thus, each magnetic tape controller can control additional magnetic tape handlers, up to and including the design capacity of eight. Similarly, additional magnetic tape controllers (up to and including the design maximum of eight) can be coupled to the control data processor.

Provision has also been made for operating several of the input and output devices independently of the central data processor through the use of the multi-purpose converter. Such use, off-line, can increase materially the output of the system within a specified period of time. Off-line operation requires no modification of the standard units.

Overall system time is saved by two types of time-sharing abilities. Where the duration of an operation on a peripheral unit is not commensurate with the speed of the processor, storage buffers are built into that unit. The processor is thus free for useful work during 96 per cent of the cycle time for a line of print and during all of the indeterminate period required by the magnetic tape system to find the record of a specified account. Another form of time-sharing is realized by the micro-programming circuitry, which can perform two functions simultaneously.

Designing a system for business use meant providing for large volumes of data and brief processes. Emphasis was therefore placed on input-output devices and on the magnetic tape system which provides large-volume storage. Costs were minimized in the processor by using a basic cycle rate commensurate with the principal business functions. Proportionately greater investment was made in the "micro-programmed" circuitry for the common business operations such as summarizing, merging, table lookup and editing. The processor's built-in business command structure handles each of these functions with a single, special command. Three-address, multiple-word commands further simplify coding and programming.

The programmer is never concerned with selecting, clearing (or not clearing), or in any other way programming the internal accumulators of the 304; this work is part of the automatic functioning of the micro-program-

med instructions. Operation of the control register is automatic, too, though flexibility has been added by making this register directly addressable.

One of the system's significant engineering features is the use of cores in the control circuitry. Advantages obtained are high reliability, lower cost, high speed and automatic coding of many detailed sequences which would ordinarily be performed by the user. This is the first time the core control technique has been used in a commercial computer, according to NCR. It has worked out so satisfactorily that the Electronics Division is now designing equipment which will make much broader use of the concept.

Automatic Checking

Accuracy of the systems is continually monitored by special error-detection features. All data moved within the system is checked from initial input to final report. Checks include: (1) photoelectric checking of all raw data, with no loss in reading time; (2) instant parity check of magnetic tape transmissions both at time of writing and at time of reading data; (3) parity check of all data transmissions handled within the processor; (4) echo checking of the printing of all records and reports; and (5) self-checking of punched paper tape and punched card output. These internal automatic tests are supplemented by the TEST instruction which may be programmed to assure proper setup of certain units prior to their use. Console switches are designed to protect against inadvertent or improper use, and interlocks are provided on peripheral units to guard against operator error.

System salesmen for the 304 are especially chosen from 3500 sales personnel. These men undergo training at the main NCR facility in Dayton. Another part of the system's sales organization is a fully qualified technical support staff.

Bringing the 304 to the production and sales stage represents the end of the most extensive single product development program ever undertaken by NCR.

Circle 102 on Reader Service Card.

SPECIFICATIONS

CLASS 304 ELECTRONIC DATA PROCESSOR

General Organization
1. Alpha-Numeric Characters
2. 10-Character Words
3. Basic 2,000 Word Magnetic Core Memory
4. 4,000 Word Model Available
5. Transistorized Construction
6. Automatic Checking of All Data Transfers
7. Special Error Detection Circuitry
8. Modular Construction

Instruction Format
1. Three-Address Commands
2. Multiple Word Operation
3. Partial or Whole Word Operands
4. Index Register Address Modification
5. Built-in Monitoring Features
6. Self-Linking Facility
7. Each Instruction an Electronic Sub-Routine

Instruction List (partial)
1. Arithmetic—add, subtract, multiply, divide, etc.
2. Logical—compare, test, extract, etc.
3. Data Handling—compress, edit, etc.
4. Business—summarize, merge, etc.
5. Magnetic Tape—read, write, search, copy, etc.
6. Input—console typewriter, punched paper tape, punched cards, etc.
7. Output—high speed printer, punched paper tape, console typewriter, etc.

Operating Speeds
1. Cycle Time .... 60 micro-seconds
2. Add Time .... 600 micro-seconds
3. Multiply Time .... 2,760 micro-seconds average
4. Sort Time (for 10,000 4-word items) ......
   4 Tape Handlers—less than 10 mins.
   8 Tape Handlers—less than 7 mins.

External Devices
1. Up to Eight Tape Controllers (8 Tape Handlers per Controller)
2. One High Speed Punched Paper Tape Reader
3. One High Speed Punched Card Reader
4. One High Speed Line Printer
5. One High Speed Paper Tape Punch

SYSTEMS UNITS

Central Processor
- Class 304 Electronic Data Processor
- Control Console
- Power Supply

Magnetic Tape File System
- Class 330 Magnetic Tape Controller
- Class 332 Magnetic Tape Handler

Input Devices
- Class 360 High Speed Paper Tape Reader
- Class 380 High Speed Punched Card Reader

Output Devices
- Class 340 High Speed Line Printer
- Class 370 High Speed Paper Tape Punch
- Magnetic Tapes

Off-Line Operations
(with Class 320 Multi-Purpose Converter)
- Magnetic Tape to Line Printer
- Punched Cards to Magnetic Tape
- Magnetic Tape to Punched Cards
- Punched Paper Tape to Magnetic Tape
- Magnetic Tape to Punched Paper Tape

(with Class 322 Printer Converter)
- Magnetic Tape to Line Printer

MAGNETIC TAPE SYSTEM

General Organization
1. Transverse and Longitudinal Parity Check on all Characters.
2. Immediate Check on all Writing.
3. Variable Length Records—100 to 1,000 characters.
4. 20,000 Characters per second Data Transfer Rate (minimum).

Magnetic Tape Controller
1. Can control up to Eight Tape Handlers.
2. All rewinds independent of Data Processor.
3. Search and Copy independent of Data Processor.
4. Search and Copy controllable on any of first eight words (80 characters) of record.
5. Search and Copy control word may have arbitrary format.
6. Electronic portion of magnetic tape file system.

Magnetic Tape Handler
1. Write lockout for master files.
2. Use lockout on rewind.
3. 2-3 millisecond acceleration time.
4. Automatic repositioning to avoid inter-record gaps.
5. Reel storage of tape—2,400 feet per reel.
6. Approximately 5,500,000 Alpha-numeric Characters per reel—as many as 350,000,000 Characters of Information Available to Data Processor on Line, if required.
7. Plastic Magnetic Tape Standard Reel.
8. Mechanical (servo) portion of magnetic tape file system.

INPUT DEVICES

Class 360 High Speed Punched Paper Tape Reader
1. 1,300 characters per second (minimum).
2. Types of input—
   (a) 5 channel punched paper tape, any code;
   (b) 6 channel punched paper tape, any code;
   (c) 7 channel punched paper tape, any code; and
   (d) 8 channel punched paper tape, any code.
3. Number of input options—3 different codes may be selected by Console switch.
4. Modes of control—
   (a) On-line to Class 304 Processor; and
   (b) Off-line to Class 320 Converter.
5. Deceleration after stop code or error halt—less than .05 inch.
6. Type of reading—optical, with checking of self-checking codes.

Class 380 High Speed Punched Card Reader
1. 1,000 cards per minute (minimum).
2. Types of input—80 column cards, 51 column cards.
3. Modes of control—
   (a) On-line to Class 304 Processor; and
   b) Off-line to Class 320 Converter.
4. Capacity of card hoppers—5,000 cards (minimum).
5. Checking features—
   (a) Dual reading stations;
   (b) Parity on decoding; and
   (c) Slipping.
6. Type of reading—optical.

OUTPUT DEVICES

Class 340 High Speed Line Printer
1. 600 lines per minute.
2. 120 characters per line.
3. Paper speed—12 inches per second.
4. Number of copies—6 (original and five copies).
5. Minimum form width—4 inches.
6. Maximum form width—22 inches.
7. Provision for checking of acceptable characters.
8. Number of characters—56.
9. Vertical format control by plastic loop and stored characters in first word of record.
10. Columnar rearrangement by plug board.
11. Modes of control—
    (a) On-line with Class 304 Processor;
    (b) Off-line with Class 320 Converter; and
    (c) Off-line with Class 322 Printer Converter.

Class 370 High Speed Paper Tape Punch
1. 80 characters per second.
2. Types of output—
   (a) 7 channel 304 code, and
   (b) any 5, 6, 7, or 8 channel paper tape, any code.
3. Number of output options—2 different codes may be selected by Console switch.
4. Modes of Control—
   (a) On-line with Class 304 Processor; and
   (b) Off-line with Class 320 Converter
5. Designed for exception reporting and data transmission by teletype.

THE RECRUITING, SELECTING AND TRAINING OF PROGRAMMERS

by T. C. ROWAN

System Development Corporation employs more programmers than any other firm in the country. The number of programmers involved—about 800—makes it necessary to give careful attention to a system of selection and training. Many companies have found it possible to train present employees as programmers during the period of transition from a manual to an automated data processing system. Others have found it sufficient to employ a few experienced programmers to work with other individuals, already in the firm, who are familiar with the company's operations. Neither of these approaches could yield any substantial number of programmers for System Development Corporation, and it was therefore necessary to develop and apply techniques for selecting and training large numbers of inexperienced but promising personnel to become computer programmers.

System Development Corporation's requirement for programmers arises, for the most part, from its role in the SAGE (Semi-Automatic Ground Environment) system of Air Defense. The SAGE system is a semi-automatic system of performing air defense developed for the Air Force by MIT's Lincoln Laboratory. Basic to the system is a series of high-speed digital computers, located throughout the country, which receive information from radar stations, from off-shore radars located on platforms known as Texas Towers, from picket ships, and from around-the-clock patrols of early-warning aircraft. Each computer also receives several other kinds of information including flight plans of friendly aircraft. It generates scope displays which show the developing air situation and which provide the basis for operators to make the judgments involved in tactical decisions. With a knowledge of flight plans of friendly planes available, hostile aircraft can be identified immediately and the computer can automatically calculate for the operators the most effective application of available weapons, such as interceptors or missiles. Through radio data link, all-weather interceptors and missiles can be guided to targets automatically by the computer.

The digital computer involved in the SAGE system, the AN/FSQ-7, was designed jointly by Lincoln Laboratory and IBM. It is a general purpose, single address, parallel, digital computer with a 32-bit word length. Its magnetic core memory contains 270,000 bits of storage and it has an auxiliary drum storage system with 3,200,000 bits. In addition it has five IBM 728 magnetic tape units and a complex buffer drum system for communication with the external environment. A large cathode ray tube display system furnishes operators with both digital information and displays representing aircraft tracks and appropriate geography and symbology. Because 24-hour operation with high reliability is a prime requirement, the central computer, the drum system, and the magnetic tape units are duplexed; that is, two complete and independent computers are part of each SAGE direction center. While one computer is actively carrying on the air defense function, the other operates on a standby basis, continuously receiving data in order that it can assume the full air defense load wherever necessary.

SDC has been working closely with Lincoln Laboratory in writing the prototype or master air defense program which directs the functioning of a SAGE direction center and in adapting this master program to the first few sites. The company will have the sole responsibility for adapting the program to remaining direction centers and for revising the computer programs as new weapons, equipments and tactics are introduced into air defense. The introduction of such changes must be accompanied by careful analysis and revision of many parts of the 200,000 order complex of programs involved in SAGE.

Recruiting Programmers

SAGE represents a significant advance in the automation of information processing and decision making, both because of its magnitude and because the operation is a real-time one. Because it is new and unusual, a significant amount of time must be devoted to specialized training, even when the programmers are experienced. Unfortunately, the situation with respect to the supply of experienced programmers is such that SDC found it necessary to recruit and train new employees in programming before introducing them to the peculiar problems of SAGE.

The task of hiring several hundred trainees was begun in 1956. Recruiting teams scoured the country, filling a quota which some months was as high as 75. The recruiters covered most of the major and medium size cities in the country. Newspaper ads were used as a pre-screening device, with the ad indicating that minimum requirements were mathematics through calculus and willingness to relocate. The personal interview was carefully planned beginning with a short introduction to the company and to the position. After this, a psychological test battery was administered (this test battery is discussed later). If the individual passed the tests, a detailed description of the job and of locations that might be involved were given the prospect. The recruiter looked for interest in programming and the computer field—as revealed, for example, by the applicant's knowledge of this general area. About two and one-half hours per person was usually expended in the interview.

This recruiting campaign can be characterized by an absence of "high pressure" recruiting practices. A straight institutional approach was used to advertising—no flashy pictures of new buildings or California beaches were used.

The general approach was one of encouraging people to find out for themselves about this new field, and then to decide whether they wanted to be programmers before becoming concerned about specifics. The recruiting campaign was quite effective; three to five recruiters were able to hire over 500 programmer trainees in a period of 15 months, with 325 of these being hired in the first six months of 1957. Offers were made to approximately one out of nine persons interviewed, with a good rate of acceptance being experienced.

The Selection Program

One of the best selection devices available to the average firm entering the computer and data processing area is a training course in programming for present employees who meet certain minimum requirements. Such an approach ordinarily makes it possible to be quite selective as to which individuals are retained for further training in programming. It is possible to use very high standards since those who fail to qualify can simply be continued in the positions they held before and during the company training course. Another advantage of this approach is that performance in a training situation can often be used

These student programmers at System Development Corporation examine equipment in the maintenance console area of the SAGE system, the AN/FSQ-7.

to predict success on a job more effectively than can psychological ability and aptitude tests as they exist today.

A variant of this approach is to hire, specifically for training as programmers, individuals who meet minimum qualifications; continue as programmers those trainees who do exceptionally well; and divert to other jobs those who do less well. Ordinarily, of course, a company is able to accommodate only a few unsuccessful trainees in other positions. This was particularly true with respect to SDC, since much of the corporation's activity is computer programming and few positions exist for unsuccessful trainees.

As mentioned above, a battery of psychological tests is included as part of the recruiting procedure. This selection program was developed while the System Development Corporation was a division of the Rand Corporation and it is reported elsewhere.[1]

As indicated in the reference, the test battery was adopted after a careful empirical analysis was performed. This analysis indicated that the Thurstone Primary Mental Abilities Test and the Thurstone Temperament Schedule could be used to predict success on the job. The subtests indicated in the referenced study and later adopted in the SAGE programmer recruiting effort were the Verbal Meaning, Reasoning, Space, and Emotional Stability subtests. A validation study of the Rand-developed selection program using SAGE programmers as subjects was carried out subsequent to the above reference. This study substantiated the earlier findings and indicated that supervisors' ratings could be predicted by the Primary Mental Abilities Test and the Temperament Schedule. A multiple correlation of .52 was found between criterion and subtest scores. This most recent validation study has just been completed, and its implications for the conduct of the selection program are being considered. Because of the continued need for large numbers of trainees, the entire procedure for obtaining them is constantly under study. While the psychological test may appear to be the focal point of examination, it is important that the entire process of recruiting, selection, and training be given an objective assessment with careful consideration being given to all aspects.

Training

After the usual new employee indoctrination, the programmer trainees are given an eight-week basic course in programming the SAGE computer, the AN/FSQ-7. This is followed by sixteen weeks of advanced training. The basic course is an SDC conducted one that has evolved from a course in FSQ-7 programming presented, on contract, by IBM during the early days of SDC's participation in the SAGE effort. As SDC's involvement in SAGE increased,

[1]Rowan, T. C. "Psychological tests and selection of computer programmers," Journal of the Association for Computing Machinery, vol. 4, 1957 (pp. 348-353).

the company assumed the responsibility for training its own employees. The course, as it exists today, is a very intense one involving six hours a day of lecture and laboratory work with the two remaining hours being study periods with instructors available for consultation. Specific homework assignments are scheduled daily.

Experience has indicated that the best programmers may or may not be the best teachers. Professional trainers have been assigned this duty; people were selected because they like to teach and preferably have experience teaching. The training is done by a service group primarily concerned with teaching programming and heavy emphasis is placed upon teaching methods. Section heads, for example, monitor classes, and teachers help each other improve their technique. Teacher rating scales are used to obtain the student reaction to course and instructor. Much effort has been invested in the writing of a text book for programming and in preparation of tests and exercises for use in the course.

The class size for the basic course is held below twenty, with two instructors per class; it was found that inefficient training resulted with a larger group. The advanced training requires more individual attention and the ratio there is usually five students to each instructor. The press of time requires that the basic course be simultaneously a course in the SAGE computer and in the SAGE system. Teaching the machine in the system context is very necessary here because of the complex interrelations involved in such a real-time application. Ordinarily a SAGE programmer works on only a small portion of the system. He must, however, understand the total system in order to appreciate the effect of special changes on other parts of the operation.

The basic training philosophy is to make the students work hard. They are given an abundance of exercise work and homework early in their training in order to give them some proficiency in using the tools of the trade. They are also given frequent examinations for control purposes and to keep them informed of their progress.

Programming the SAGE computer is, aside from the use of the extensive drum system, essentially like programming any other large general purpose digital computer. (Of course, as we mentioned previously, using such a machine for real-time decision making is quite a different application from that usually faced by programmers.) The first two days of the course (12 hours of lecture) are devoted to number systems and to fundamental concepts and generalized computer theory. Octal instruction codes are taken up on the third day and from then until the end of the eight weeks, the students are immersed in lecture, laboratory, quizzes, and homework.

The FSQ-7 is, for the novice, (and for that matter, for everyone) an awe-inspiring phenomenon. It covers an area of about 26,000 square feet—about half the size of a football field—and it contains more than 50,000 vacuum tubes. It is not easy to convince the programmer trainee that he, as a programmer, can control this complex array of electronic equipment. In order to impress upon the trainees that without the program, it is only a piece of equipment, all students by the end of the second week are running simple problems on the machine, and toward the end of the eight-week course the students are given a more complex problem, similar to those involved in the SAGE system, which must be programmed and run successfully on the computer.

Formerly, because of the critical shortage of personnel, students completing the basic course were assigned to one of two advanced courses. One of these was concerned with the planning and the analysis of tests and programs used in air defense; the other group was trained in the many intricate procedures necessary to successfully check out a complex real-time program in the field. These two advanced courses have now been combined into one 16-week course. This makes the individual, after he has finished both basic and advanced training, a much more valuable employee, since he has been trained in all aspects of SAGE programming from initial conception of a problem to final checkout in the field. Not only does he have a sound, basic understanding of the art of programming digital computers, but he also understands and is able to apply the special tools needed in this new computer application.

These basic skills are not acquired without effort. There are no known cases of students who thought the course easy. Graduates of the course, however, indicate that they are—after it is over—happy that the course was difficult; they feel that they then have the necessary equipment to continue their professional development. One instructor, when asked to comment on the philosophy leading to this result, attributed it to hard work: "Our philosophy is to load students up just beyond their capacities so that thoughts of codes and equipment become automatic, enabling them to use their brains."

Obviously, such a training program is appropriate for only the largest of installations. The course is in marked contrast with the more usual approach of training, on the job, a small number of individuals. The SDC course is much more comparable to courses given by equipment manufacturers.

SDC's requirement for computer programmers is admittedly a special one. However, the fact that one company found it necessary to hire and train such a large number of programmers highlights the tremendously expanding field of computer programming and the concomitant training requirements. This expansion is dramatically illustrated by the fact that a speaker at the First Conference on Training Personnel for the Computing Machine Field, held in 1954, stated that all of the computer manufacturers seemed capable of providing, during the following twelve months, 2,500 student weeks of instruction. Three years later during a comparable period, SDC devoted more than 10,000 student weeks to instructing its own personnel to program.

CONFERENCE REPORT

WJCC

Now that this year's Western Joint Computer Conference has been run through the swanky, king sized computer known as Los Angeles' Ambassador Hotel and the thousands of "programmers" have returned to their firms all over the country, those who put the conference together are unanimous in their agreement that the gathering on May 6, 7 and 8 was a highly successful one.

That this conclusion is valid is attested to partly by the impressive number of registered delegates—close to 2,000 (with additional thousands touring the exhibit areas each day)—and partly by the interest displayed and the opinions expressed by these delegates.

Some of these opinions will be found on the following two pages. These statements and hundreds more offered at the conference seem to break down to at least three main conclusions.

First, there is more emphasis today on peripheral equipment and this trend is good because it shows that the industry is maturing. Second, the panel discussions and technical sessions, though somewhat limited in their effectiveness by competitive caution, still provide a great opportunity for the exchange of information. And third, "seeing is believing" continues to be the biggest incentive for touring the exhibit areas.

Top: Opening session panelists Cuthbert C. Hurd (left), B. J. Schafer (center) and Harold D. Lasswell discuss conference program highlights with WJCC chairman Willis H. Ware at press conference held prior to their addresses. Lower: These delegates are enjoying comfortable seating as they listen to the panel begin conference proceedings.

Top: Delegates' wives pose near bus used for tour of Southern California points of interest during conference. Lower left: One of the 1,800-plus delegates registers. Lower right: Chairman Ware, vice-chairman Harry T. Larson and registration chairman Marvin Howard check attendance figures shortly before conference closes.

1961 CONFERENCE FEEDBACK

WJCC

these are answers to some questions asked about the wjcc, the data processing industry, and conferences in general

ERIC WEISS, DAYSTROM SYSTEMS— I've noticed that there are fewer design people and many more "users" at this conference. There's been a definite trend in this direction at other data processing conferences and shows. I think this is a sign that the industry has grown up. Unfortunately, there's not much in the way of new things here for engineers. These conferences could be much more effective if a freer exchange at panel discussions and technical sessions were possible. Personally, I think this policy of having everyone be ultra cautious is very unfortunate.

ELDRED NELSON, RAMO-WOOLDRIDGE CO. — I think the informal communication at these conferences is as important as the formal. But I will say this: there is a tendency to play down the technical papers and sessions. These formal sessions provide a medium to report on accomplishments. Many times they provide a stimulus for a person to write something which might otherwise not be written. As for the exhibits —by seeing equipment actually operating, problems can be posed and discussed. This in turn could and often does lead to the purchase and use of other equipment.

MATTHEW A. ALEXANDER, DIGITRON, INC. — These conferences provide probably the best and only way to see what others in the field are doing. The various companies may hold back information for competitive reasons but the first suggestions of what they are doing are evident in papers and general discussions. Actually these conferences are kind of a game played with information. On the one hand, a firm doesn't want to tip its hand but in a year

they would like to say that a year ago they presented a paper on a new development.

MARY K. HAWES, ELECTRODATA — There seems to be a trend at the technical

sessions toward general discussions. I think this is a good thing because it's often possible to get more out of the discussions than from the papers. I think the greatest advantage in holding these conferences is found in meeting people and discussing mutual problems with them.

S. DEAN WANLASS, AERONUTRONIC SYSTEMS, INC.— These conferences provide the ideal place to display new equipment. More people will become familiar with your product more quickly than under any other circumstances. At this particular conference, the technical content of the papers is excellent.

J. H. FELKER, BELL TELEPHONE, MURRAY HILL, N. J.—As far as this industry generally is concerned, a great many things have settled down. There are many choices available in equipment. Problems are not problems of feasibility but are now concerned with the best way to do a thing. Buyers are concerned now with the most reliable and least expensive equipment.

J. P. NASH, LOCKHEED MISSILE SYSTEMS DIV.— Despite the fact that the number of different companies coming into the industry has increased enormously in the past year or two, I feel the computer industry is on solid ground. This industry is a larger segment of the electronics industry than ever before. The technical sessions and panel discussions at this conference have brought people together to discuss new developments. One can come away from this conference with the knowledge that he has enriched the knowledge of the field.

ROBERT A. SEYMOUR, AERONUTRONIC SYSTEMS— Many times you can't get all out of a conference you might. This is especially true when you compare technical sessions and panel discussions. For me, a panel discussion is worth much more than anything else at the conference.

DR. MARTIN J. KLEIN, COHU ELECTRONICS—I attended the Western Joint back in 1956 and I've noticed a lot of equipment here now that I saw then. The only difference is that now, everything works. As you go through the exhibit areas, you see much more peripheral equipment displayed than actual computers. One of the limitations of the in-

dustry has been the lack of this input-output equipment. Now that's being remedied. I feel that the panel discussions are worth much more than the technical sessions. There is no "last word" in this industry. As for conferences in general, there are many, too many of them. This could make papers worthless because it spreads them over too thin an area.

THOMAS R. PARKIN, SYSTEMS DEVELOPMENT CORP.—I notice that manufacturers are becoming more realistic toward people who use the equipment and are responsible for purchasing it. I have been exceedingly interested in the appearance of specialized yet flexible peripheral equipment.

EDWARD G. DUNAWAY, HQ, USAF, WASHINGTON, D. C. —I think the theme of this conference, "Contrasts in Computers" is very topical. There is much more expansion and growth in the industry now and a theme such as this was needed. These conferences are important to the Air Force because they provide a ground on which we can solve many problems concerning our equipment. As users, we are interested in applications using scientific approach for solving business problems. We are able to arrive at solutions to problems almost impossible to solve otherwise.

PHYLLIS HUGGINS, BENDIX COMPUTER —Where this used to be an intimate gathering, half the world now seems to be beating a path to our door. This is a sign that the users are becoming much more informed about the industry and are coming to the manufacturers with some definite ideas as to what they want and how they want it.

JAN A. RAJCHMAN, RCA LABS, PRINCETON—It's clear that the industry is maturing and growing. I'm one of the "old-timers" in this business and I'm in a position to know that this is so. When we first started out, we were talking about the possibility of creating this or that piece of equipment. Now, as evidenced by the opening session, we are talking about the social implications of datamation. These conferences are important from the standpoint that they provide a place for quick exchanges of information in the field. I think attending panel discussions is much better than listening to a prepared paper someone has to rush through.

GORDON GOLDSTEIN, OFFICE OF NAVAL RESEARCH —I notice that the ex-

hibits are very specialized in tone—none of this elementary business. This makes the exhibit area much more interesting to those of us in the computer field. It's clear that companies realize this by the high level of personnel they have chosen to man the booths.

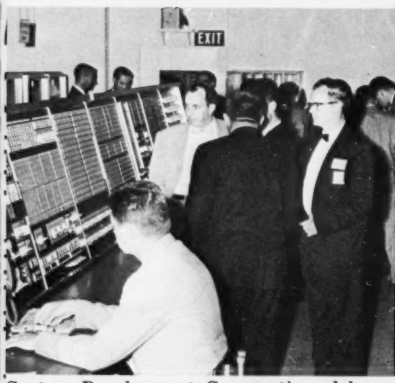
JAMES HELFRICH, G. S. MARSHALL (REPRESENTING F. L. MOSELEY CO.)—This is the best show of its type I've attended in years. There's been a good response here at our booth and I've noticed a concentration of significant peo-

ple. Many times these things are nothing more than tours for housewives and Boy Scouts, etc. I think the booths are valuable because they allow people in the industry to become familiar with what equipment is being produced and is available.

JOHN M. BENNETT, BASSAR LAB., UNIV. OF SYDNEY, AUSTRALIA—I am most impressed by the exhibit area. There are many pieces of equipment here I have heard about and now I'm seeing them for the first time. In Australia, we have conferences of this type but not as frequently as in the U. S. The conferences themselves in addition to the exhibits, are, of course, valuable.

WJCC FIELD TRIPS

Over 100 WJCC delegates viewed the data reduction center in Space Technology Laboratories, a division of Ramo-Wooldridge Corp. Here, on May 7 and 8, they saw demonstrations of Remington Rand's UNIVAC 1103A and an IBM 704.



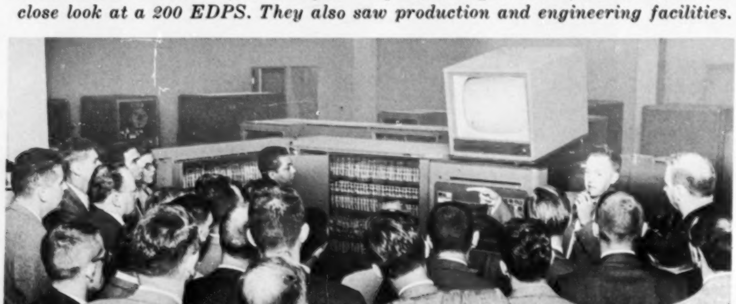
System Development Corporation, dele-
es observe the SAGE computer at the
ntenance console area.

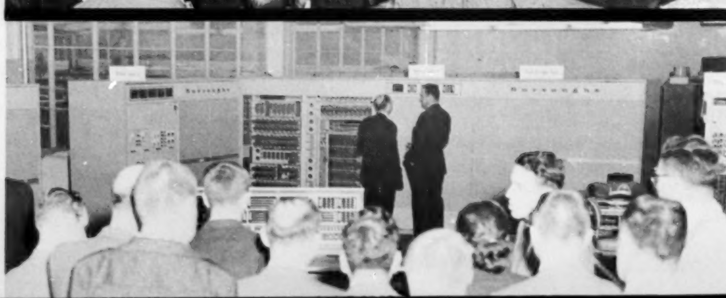
The Test and Inspection Department at Bendix Computer Division was another stop for touring conference delegates.

Featured at NCR's open house were an etched chassis and a core plane of the types used in the National 304 EDPS.

A large WJCC group toured the Computing and Datamation Center at Northrop Division, Northrop Aircraft. They are being briefed on the center's IBM 704.

ElectroData Division of Burroughs Corporation offered conference visitors a close look at a 200 EDPS. They also saw production and engineering facilities.





people moving up in DATAMATION

Kenneth R. Herman has succeeded James H. Rand, as president of the Sperry-Rand Corporation's Remington Rand Division. Herman, onetime president of the S-R subsidiary, Vickers, Inc., was named to the post in April. He joined Vickers in 1931 as a project engineer. . . . Vice Adm. E. D. Forester, USN (ret.), has been appointed vice president and general manager of RCA's revamped electronic data processing division. Forester is a former Chief of the Navy's Bureau of Supplies and Accounts. Other appointments in the division—J. W. Leas is chief engineer, A. R. Hopkins is sales manager, and F. L. Jones is product planning manager. . . . Allan I. Benson has been promoted to manager of scientific applications, one of the eight sections of the GE computer department in Phoenix and the section responsible for the operation of the Arizona State computer center, Tempe, Arizona.

Election of three new vice presidents in Space Technology Laboratories, a division of the Ramo-Woodridge Corp., Los Angeles, was announced in April. Dr. Milton U. Clauser was elected vp and director of the physical research laboratory; Allen F. Donovan, vp and director of the aeronautics laboratory; and William F. Duke, vp and associate director of the systems engineering division. The actions were taken at a meeting of Ramo's board of directors.

Waldorf Instrument Co., electronics division of F. C. Huyck and Sons, designated Robert Tate as director of customer liaison and service. Tate has had 20 years experience in activities related to the relatively new fields of airborne computers, aircraft instrumentation and packaged subsystems. . . . Technical Operations, Inc. announced a number of additions to its various groups both at home and away from company headquarters at Burlington, Mass. Now with the operations research group are John D. Bassett, Roger F. Willis and Norman Hopgood, Jr. Joining the firm's mechanical engineering staff was Ronald T. Bradshaw. And Vincent J. Ryba is now with the weapons group in the combat operations research group, Ft. Monroe, Va. The Air Force operations model evaluation group is larger by two—Bernard Urban and Stephen Warshall. Maurice F. Deatrick has joined TO's experimentation center as an operations analyst.

Richard A. Terry has been named manager, advertising and sales promotion, for Telemeter Magnetics, Inc., Los Angeles. Prior to his appointment, Terry was with Univac in St. Paul. He also served with Minneapolis-Honeywell, Philadelphia. Robert D. Schmidt is the new eastern regional manager for TMI. Schmidt, active in the digital computer field for many years in both engineering and sales, has established offices at 306 H St. N.W., Washington 13, D. C.

Ray R. Eppert, who joined Burroughs Corporation as a shipping clerk in 1921, was named by the board of directors in Detroit to succeed John S. Coleman as president. Eppert, who accepted the position in April, has been executive vice president since May 1951 and a member of the board of directors since October 1948. He now heads a corporation which employs nearly 33,000 persons. . . . Leon Weiss has joined Electronic Control Systems Division of Stromberg-Carlson in the capacity of staff engineer, data processing section. At ECS, Weiss will be concerned with the development of special purpose digital data processing and computing systems.

In Waltham, Mass., F. J. Anderson has been named manager of the newly formed data processing laboratory, one of four Sylvania Electronic Systems division labs there. Anderson joined Sylvania in 1947 as an engineer and had been assistant manager of the firm's avionics lab prior to his new appointment. Also at Sylvania, Richard W. Couch has been chosen project manager for the Air Force's Ballistic Missile Early Warning System data processing project.

Kenneth R. Herman — *President, Sperry-Rand's Rem-Rand*
Dr. M. U. Clauser — *Space Technology's Physical Research*
Robert Tate — *Waldorf Instrument Company*

Richard A. Terry — *Telemeter Magnetics, Incorporated*
Ray R. Eppert — *President, Burroughs Corporation*
F. J. Anderson — *Sylvania Electronic's EDP Lab*

new products in DATAMATION

Amplifiers, Power Supply

Four new record amplifiers and a new power supply, designed for in-flight testing with magnetic tape instrumen-

tation, are now available. Featuring printed wiring, transistors and modular construction, the new units will operate at temperatures up to 100°C. The four interchangeable modules are designed to provide analog, analog with voice, pulse duration modulation or frequency modulation recording on tape. Any combination of the modules can be housed in a special amplifier case. Two record amplifier cases (14 channels) may be stacked with the power supply which will operate all 14 amplifiers. For information write CONSOLIDATED ELECTRODYNAMICS CORP., 300 N. Sierra Madre Villa, Pasadena, Calif.

Circle 150 on Reader Service Card.

Voltage to Digital Converter

A new instrument designed to operate either as a digital voltmeter or as an analog-to-digital converter is capable

of 2000 completely independent conversions per second. It is completely transistorized to eliminate noise and heat and to reduce maintenance to a minimum. When used as a digital voltmeter, this machine attains high speeds so that visual display looks continuous allowing the user to read both forward and backward without difficulty. When used as an analog-to-digital converter, it can be incorporated into practically any system because of the variety of outputs provided. For information write ADAGE, INC., 292 Main St., Cambridge, Mass.

Circle 151 on Reader Service Card.

High Speed Relays

A new design factor is the enclosure of R-500 and RS-500 miniature high speed relays' contacts in separate, her-

metically sealed compartment within the outer case, also hermetically sealed. This double sealing in inert gas eliminates possibility of contact contamination to the extent that not even volatile emanations from warm cells or wires can affect contacts. The series is being manufactured with close dimensional tolerances, the manufacturer claims. Uniformity is assured by putting each relay through initial adjustment, 15-hour run-in period, thermal cycling alternating from –65°C. to 125°C three times, final adjustment, a second 15-hour run-in and final adjustment check. For information write IRON FIREMAN MANUFACTURING CO., Electronics Div., 2838 S. E. 9th Ave., Portland, Ore.

Circle 152 on Reader Service Card.

Discriminator and Filters

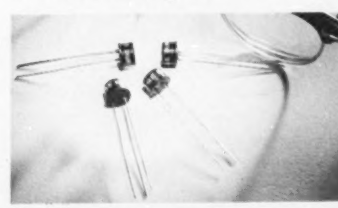
Model GFD-2 discriminator and associated bandpass and lowpass filters is now in production and available

for use in radio telemetry ground stations and data reduction centers. The unit converts frequency modulated subcarriers into intelligence signals at output levels suitable for recording with penmotors or galvanometers. The GFD-2 is directly applicable to recording systems at any one of the standard tape speeds. Channel characteristics are selected by plug-in filter units from the front panel. For information write DATA-CONTROL SYSTEMS, INC., 39 Rose St., Danbury, Connecticut.

Circle 153 on Reader Service Card.

Switching Transistors

Now in production is a line of four new PNP medium speed switching transistors having less than a 20%

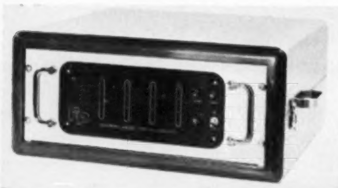


change in hFE and Ico after four-thousand hours storage at 100°C. The four transistors have been JETEC type-designated 2N394, 2N395, 2N-396 and 2N397. They are designed for use in digital computers and other switching applications where highly stable components are required for maximum overall equipment reliability. For information write GENERAL ELECTRIC COMPANY, Semiconductor Products Dept., Section RWS, Syracuse, N. Y.

Circle 154 on Reader Service Card.

Analog-to-Digital Converter

A fully transistorized analog-to-digital converter with a speed of 6000 independent conversions per second is



available. The new solid state converter operates at the rate of 100,000 bits per second, has an accuracy of .05% of full scale and a minimum full scale of 5 volts. Preamplifiers can be supplied to achieve better sensitivities. The converter operates by comparing analog input voltages with an internal reference voltage derived by summing weighted current from a precision power supply. A conversion can be initiated by a push button on the front panel or by an externally applied 2-volt transient. For information write FISCHER & PORTER CO., 641 Jacksonville Road, Hatboro, Penna.

Circle 155 on Reader Service Card.

Automatic Multiple Switch

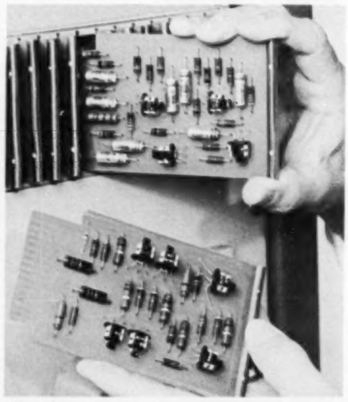
Automatic multiple switching is an accepted method for handling complex data in programming, automatic in-

spection, production control and computer work. This unit is a self-actuating type mechanism built around 187 self-cleaning, wiping type switches. The design has been life tested to over 100,000 operations without failure. The relatively high current carrying capacity (10 amperes) and the contact to pin resistance (.00025 ohms nominal) of this design invites use in applications where automatic multiple switching arrangements require unusual flexibility with low loss of current carrying capacity. For information write HICKOK ELECTRICAL INSTRUMENT CO., 10514 Dupont Ave., Cleveland 8, Ohio.

Circle 156 on Reader Service Card.

Read/Write Amplifiers

These all-transistorized read/write amplifiers now provide the system designer with a complete set of build-



ing blocks for digital magnetic tape applications. The circuits may be incorporated into any type of digital system, since voltage levels are compatible with either transistor or vacuum-tube systems of logic. Modular design adapts the circuits to use in systems of any number of channels. Each amplifier is packaged on an etched circuit plug-in card 3¾ in. x 5½ in. A typical read/write system for eight channels, consisting of write amplifiers and transitional output circuits, is contained in a single module occupying 3½ in. of panel space. For information write DECISIONAL CONTROL ASSOCIATES, INC., 14141 Stratton Way, Santa Ana, Calif.

Circle 157 on Reader Service Card.

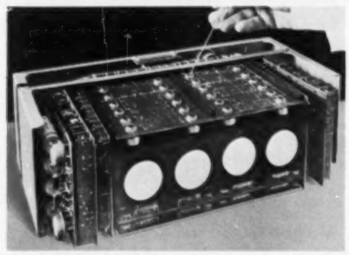
Power Transistors

A new series of power transistors is rated from 1 to 1.2 watts maximum power dissipation and consists of general purpose audio transistors, a 1 mc transistor for communication or switching applications and a pulse amplifier. These transistors will find extensive application wherever a transistor of high voltage, current, and power ratings is required. For the first time relays requiring 3 amperes at 40 volts may be operated by a transistor in a small studded case and standard basing. These transistors are particularly well suited to data processing, instrumentation and control applications. For information write PHILCO CORP., 4700 Wissahickon Ave., Philadelphia 44, Penna.

Circle 158 on Reader Service Card.

Digital Display Device

This device features all-electronic circuitry. It has no moving parts. It has printed circuit plug-in panels with

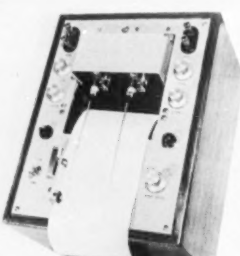


completely passive components. On its two-inch cathode ray tubes it provides readout for two, four or six digits, with wide angle viewing, low power consumption, and ultra-fast response. The chassis has eleven plug-in, printed circuit panels, necessary to the four digit cathode tubes. The panel on left is the power supply; the next is the number generating panel for tubes one and two; the third is for high voltage; the two top panels are control units, one line each for the four tubes; the four bottom panels are for gate control; the two units at the right are a power unit and a number generating unit for tubes three and four. For information write HOFFMAN ELECTRONICS CORP., Semiconductor Div., 930 Pitner Ave., Evanston, Ill.

Circle 159 on Reader Service Card.

Strip Chart Recorder

Recording electrical data from d-c to 100 cps is the function of the ER-20 direct-writing strip chart recorder. The

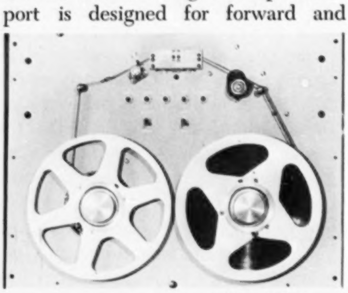


unit features direct-coupled amplifiers which give a sensitivity of 2 MV/mm. Stylus deflection on each channel is 40 MM with an accuracy of 2%. Electro-sensitive paper eliminates the need for any inking system. Easy paper loading and an electrically controlled two-speed chart drive make operation simple. For information write MANDREL INDUSTRIAL INSTRUMENTS, 5134 Glenmont Dr., Houston, Texas.

Circle 160 on Reader Service Card.

Magnetic Tape Transport

Equipped for automatic or manual operation, the new magnetic tape transport is designed for forward and

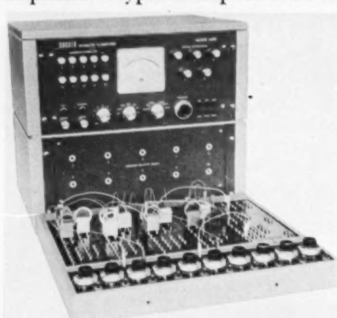


reverse operation at speeds of 7.5 and 3.75 in. per second. Series 610 is further provided with forward and rewind speeds of 2,400 ft. in two minutes. During automatic operation, the tape handler goes into high speed rewind automatically when the rear end-of-tape strip is detected. Upon completion of rewind the tape is stopped and repositioned for another cycle when the front end-of-tape is detected. Provision has also been made for over-riding automatic operation for normal rewind to change the tape reel. For information. write AMERICAN ELECTRONICS, INC., Data-Tronics Div., 655 W. Washington Blvd., Los Angeles 15, California.

Circle 161 on Reader Service Card.

Analog Computer

Model 3400 offers 0.1% performance with chopper stabilized printed circuit amplifiers. A typical computer contains

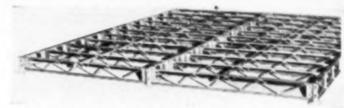


10 amplifiers, five initial condition power supplies, and supporting control and metering circuitry. Key features: positive and negative reference voltage available at problem board, removable problem with expanded jack field, repetitive or continuous operation for scaled and real time solutions, simultaneous control of multiple computer arrangements from any one computer or from remote station, individual overload indicators and amplifier balance controls, and operation from 115 to 230 volts, 50-60 cps power. For information write DONNER SCIENTIFIC CO., Concord, Calif.

Circle 162 on Reader Service Card.

Computer Platforms

Inner construction of this computer flooring consists of steel posts and open-web girders and purlins, joined

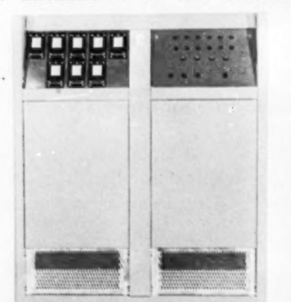


in a rigid structural frame by means of interlocking components. The open webs provide ample space for electrical connections between computer units. The platform is then floored with special plywood and tile panels, and sides are closed in producing a plenum chamber for distribution of conditioned air to the computer units. Standardized components provide framing for a foot-high platform to fit any required area. Two men can assemble 400 sq. ft. of such a platform in 30 minutes, say the manufacturers. For information write MACOMBER, INCORPORATED, Canton 1, Ohio.

Circle 163 on Reader Service Card.

Data Translator

Design of this unit is based on the building block concept whereby custom installations to suit individual



needs can be constructed from standard modules. These data translators provide compatability between computers of different designs via almost any conceivable combination of punched cards, paper tape or magnetic tape. Reliability and accuracy are said to be high owing to the use of solid state components and internal automatic checking codes. For information write TELEMETER MAGNETICS, INC., 2245 Pontius Ave., Los Angeles 64, California.

Circle 164 on Reader Service Card.

X-Y Recorder

Model 6 is designed for rack mounting and is completely self-contained. It provides facilities for curve drawing,

curve following, and point plotting from two variables in almost any application where data can be reduced to electrical form. With available accessories it may be used for punched card reading, automatic gain-frequency curve drawing, perforated tape reading, and numerous other time and labor-saving operations in research, development and industrial applications. For information write F. L. MOSELEY CO., 409 N. Fair Oaks Ave., Pasadena, Calif.

Circle 165 on Reader Service Card.

Trace Reader and Computer

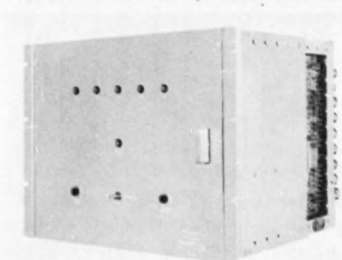
Designated the model 12 OTRAC, the unit is a semi-automatic multiple trace reading machine having controls to

permit direct reading, in tabulated form, of the digital parameters to which the traces correspond. Up to ten or more traces may be read sequentially by manually positioning a cross-hair on the X and Y axes. The cross-hair position controls two proportional analog voltages, corresponding to the X and Y coordinates. Scale factor and zero corrections are automatically applied to the voltages and the result is then applied to the input of a digital voltmeter. The reading of the voltmeter is then recorded by an automatic typewriter and simultaneously punched out on paper tape or cards. For information write NON-LINEAR SYSTEMS, INC., Del Mar, Calif.

Circle 166 on Reader Service Card.

Sample-Hold Multiplexer

A system building block module designed to provide the means to more feasible data control, model EM-51S



time multiplexes five separate voltage inputs to a single voltage output. Several of these five-channel modules can be interconnected to produce a single voltage output. For example, four of these units would provide for the multiplexing of 20 channels of input data to one single voltage output channel. The sample and hold feature makes possible the simultaneous sampling within 0.2 microseconds of any number of channels of highly dynamic data. For information write EPSCO, INC., 588 Commonwealth Ave., Boston 15, Mass.

Circle 167 on Reader Service Card.

Tape Monitors

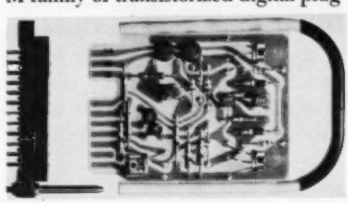
With applications in telemetering and many similar jobs, model P-106-B in-

cludes six panelscopes mounted in a standard 19-in. rack panel, 14 in. high. A power supply and sweep generator for up to 14 monitors is contained in an associated unit. The control of one of these latter units, having two settings, permits quick calibration or normal operation. In the calibrate position, 1 x 2¼ in. resters are displayed indicating that the system is in calibration and operating correctly. The monitors are designed to indicate full scale vertically or horizontally with an input of 1 volt RMS with a response of DC to 300 KC within 3 db. For information write WATERMAN PRODUCTS CO., INC., 2445 Emerald St., Philadelphia 25, Penna.

Circle 168 on Reader Service Card.

Transistorized Flip-Flop

Shift flip-flop model SF 101 is a new addition to the manufacturer's series M family of transistorized digital plug-



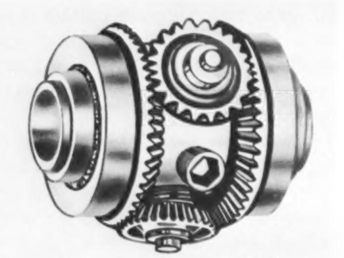
in packages. The circuit is mounted on an etched copper-clad epoxy laminate. Overall package size is 2½ X 4 in. The 12 pin printed circuit with its polarizing guide pin is supplied with the plug-in package. The package handle is color coded for identification. SF 101 is intended specifically for slow speed shift register applications. Maxi-

mum shift rate is 2 kilocycles. Intermediate circuitry or components are not required between stages as each unit is capable of driving the next such package directly. For information write COMPUTER CONTROL CO., 92 Broad St., Wellesley, Mass.

Circle 169 on Reader Service Card.

Micromation Differential

Designed especially for miniature servo and computer applications, this new differential weighs 0.2 oz. and is

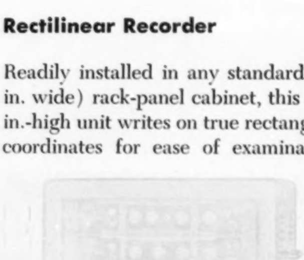


the smallest unit available for a 1/8 in. shaft, according to the manufacturers. A maximum load rating of 5-6 oz.-in. and a 500 rpm maximum operating speed are recommended. For information write WALDORF INSTRUMENT COMPANY, Electronics Division, Huntington Station, Long Island, New York.

Circle 170 on Reader Service Card.

Rectilinear Recorder

Readily installed in any standard (19 in. wide) rack-panel cabinet, this 12¼-in.-high unit writes on true rectangular coordinates for ease of examination.

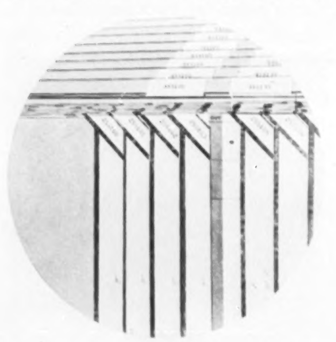


Write-out is by the heated stylus method with an individual stylus heat control for each channel. Available with from two to six recording channels, the recorder features flat frequency responses to 70 cps. It will record almost any known phenomena. For information write EDIN CO., INC., 207 Main St., Worcester 8, Mass.

Circle 171 on Reader Service Card.

Filing System

A new system in which any one of 16,500 punched data processing cards can be located in three seconds or less

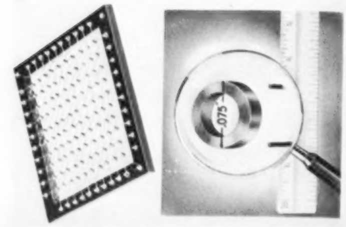


for feeding into IBM machines has been announced. Using specially notched cards, the system employs open-tub housing units filled with banks of the cards. Within each bank, the cards are offset horizontally so that a 3/4 in. margin, on which the card number or name is printed, is instantly visible for easy scanning and selection. The operator flicks open the proper bank and extracts the proper card. All thumbing is eliminated—the only card touched is the one wanted. For information write VISIRECORD, INC., Copiague, N. Y.

Circle 172 on Reader Service Card.

Transistorized Memory Circuits

Specifically designed for transistorized memory circuits and requiring low driving current, the M3 memory core has a switching time of two microseconds with a current of 450 milli-

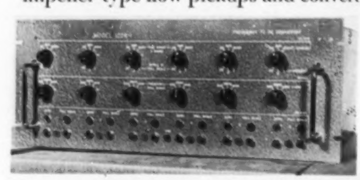


amperes at 40°C. It can be furnished in complete arrays, such as the 10 by 10 memory array (illustrated), and is delivered 100% tested to guaranteed specifications. The toroid cone measures .075 in. OD x .048 in. ID x .022 in. thick. For information write FERROXCUBE CORP. OF AMERICA, 50 E. Bridge St., Saugerties, N. Y.

Circle 173 on Reader Service Card.

Converters

Series 1220 converters accept inputs directly from any of the commercial impeller-type flow pickups and convert

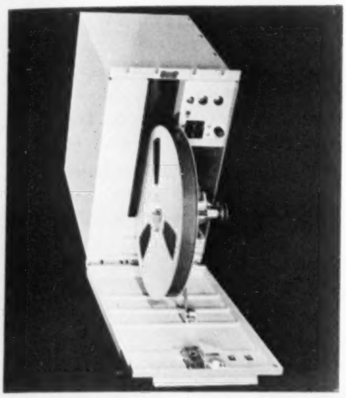


the input frequencies to a DC voltage for direct analog recording or high speed digital processing. The unit provides selectable time constants from one millisecond to two seconds; full scale frequency ranges of 500, 2500, and 10,000 cps; one to five channels per 19 in. rack; will make frequency conversions to 50,000 cps with 10 volts (1 MA) DC full scale output for a selected full scale frequency. For information write SYSTRON CORP., 2055 Concord Blvd., Concord, Calif.

Circle 174 on Reader Service Card.

Tape Degausser

A new automatic bulk tape eraser performs the function of removing previous data and noise from magnetic tapes. The degausser accommodates all types of metal and plastic reels in tape



widths up to one inch and in diameters seven through 14 inches. Designed basically for NARTB reels, the unit can also take business-machine and special type reels by using a spindle adaptor. In operation, a reel of tape is placed on a spindle and the door is closed, initiating the automatic degaussing cycle. Moments later a green signal light indicates completion of the cycle. For information write AMPEX CORP., 934 Charter St., Redwood City, Calif.

Circle 175 on Reader Service Card.

Counter Line

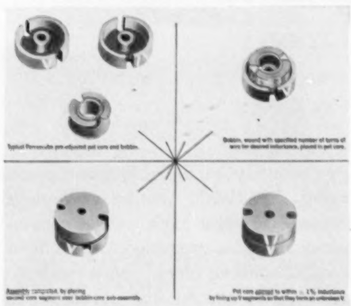
All the manufacturer's counting, timing and frequency measuring equipment, which formerly operated at a basic

counting rate of 100 kc, has been redesigned to perform at a basic counting rate of 200 kc. Involved in the change are model 211A frequency-period meter, model 225A universal counter timer, models 200A and 201A frequency timers, and model 202A time-function translator. From a technical standpoint, the manufacturer states, the 200 kc units fill a need in the 100 to 200 kc range previously met only by more expensive one-megacycle counting equipment. For information write COMPUTER - MEASUREMENTS CORP., 5528 Vineland Ave., North Hollywood, Calif.

Circle 176 on Reader Service Card.

Ferrite Pot Cores

Each of these pre-adjusted ferrite pot cores has a V line drawn across its two halves. After the user winds the

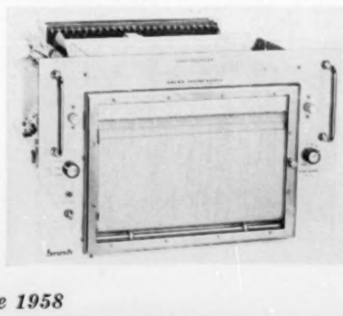


core with the required fixed number of turns of wire, he lines up the V segments so that they form an unbroken V and automatically obtains the required inductance. No other production steps are necessary. A full line of the cores is available for telemetering, communications and telephone applications. For information write FERROXCUBE CORP. OF AMERICA, 50 E. Bridge St., Saugerties, N. Y.

Circle 177 on Reader Service Card.

Event Recorder

Model 3610 permits recording of 100 channels of sequential or operational

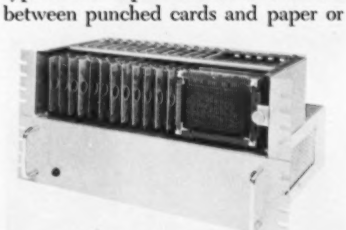


information simultaneously—indicating any number of events pertaining to electrical or physical phenomena. It records static and dynamic data on a moving chart 12 in. wide and 500 ft. long. A record of events, their duration and their time relationship to each other, appears on the chart less than one millisecond after the electrical current is switched through the stylus. The electric writing method provides dry and permanent charts. Rapid response permits up to 500 signal changes per second. For information write BRUSH INSTRUMENTS, Division of Clevite Corp., 3405 Perkins Ave., Cleveland 14, Ohio.

Circle 178 on Reader Service Card.

Punched Card Buffer

This new magnetic core memory unit, type 80-CB-7, provides communication between punched cards and paper or



magnetic tape. The unit stores up to 80 alpha-numeric characters to accommodate the full contents of a standard card. Additional applications include transfer of card data to computers, digital control systems, and remote transmission equipment. The unit is compact and is said to provide a high degree of reliability as a result of solid state design. Transistors, diodes and ferrite cores are used as active elements. For information write TELEMETER MAGNETICS, INC., 2245 Pontius Ave., Los Angeles 64, Calif.

Circle 179 on Reader Service Card.

Serial Memory

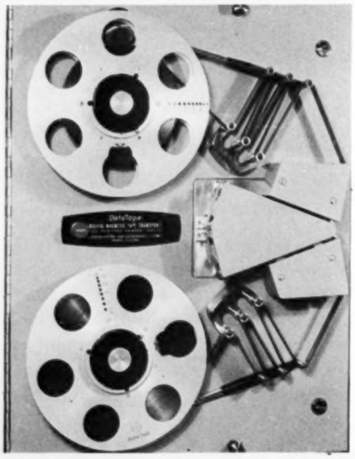
Model SM-10 consists of two basic sections, a magnetostrictive delay line and an amplifier-driver. The amplifier-

driver section is mounted with the delay line to give a physically integrated package which plugs into one connector of the t-bloc. The SM-10 is simply a delay unit with amplifiers. It does not incorporate any logic. It is designed to be driven by a standard gating package with "write-in" and "erase" control exercised at this point. The unit's output is similar in load driving capability to an LE-10 package. Both assertation and negation outputs are provided. Delays up to 560 microseconds are available in an SM-10. For information write COMPUTER CONTROL CO., INC., 92 Broad St., Wellesley 57, Mass.

Circle 180 on Reader Service Card.

Magnetic-Tape Unit

This digital magnetic-tape recorder/reproducer provides users with standard speeds ranging from 7½ to 100

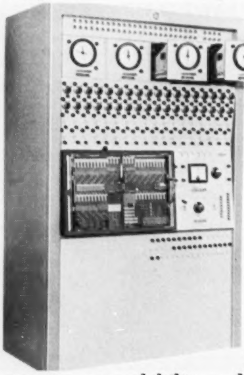


ips. Two low speeds (0.4 and 0.8 ips) and a high speed of 150 ips are also available. Tape widths are ¼, ½, ¾ and one inch. Start and stop times are less than three milliseconds with a guaranteed accuracy of 0.05 in. in both forward and reverse directions. For information write CONSOLIDATED ELECTRODYNAMICS CORP., 300 N. Sierra Madre Villa, Pasadena, Calif.

Circle 181 on Reader Service Card.

Analog Computer

The manufacturer of the MC-5800 analog computer claims that it differs in concept from other computers in

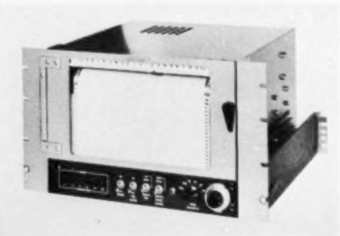


two respects: expandability and packaging. The basic computer employs expanded circuit logic so that a computer may be expanded in the field on a "building-block" basis without rewiring or mechanical modification. Expansion may be accomplished with respect to function as well as size. In the new packaging technique, an equipment door on which all operational and control components are mounted is featured. For maintenance, the equipment door swings clear of the cabinet providing unobstructed access to front and rear. For information write MID-CENTURY INSTRUMATIC CORP., 611 Broadway, New York, N. Y.

Circle 182 on Reader Service Card.

Strip Chart Recorder

Model 80 strip chart recorder is designed especially for laboratory use in applications requiring strip form records in a variety of chart speeds. This

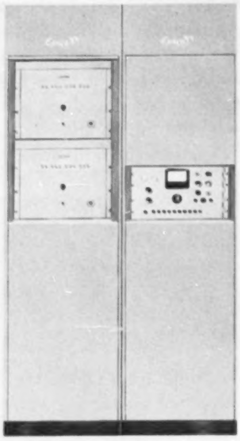


instrument provides push-button chart speed selection, a 10-inch chart width, multiple-range span controls and remote control facilities. Model 80 is completely transistorized. The entire chart transport is mounted on slides permitting it to be drawn forward to a fully exposed position for chart installation or inspection. For information write F. L. MOSELEY CO., 409 N. Fair Oaks Ave., Pasadena, Calif.

Circle 183 on Reader Service Card.

Linkage System

Modularized addaverter computer linkage systems to maximize computer utility through on-line bi-directional



communications between analog and digital computers are now available. A basic addaverter system handles five channels of analog data and five channels of digital data—a basic linkage system which can be expanded. Digital data from the digital computer is converted to five proportional analog voltages and presented on command to the analog computer; similarly, five channels of analog voltages in the analog computer are simultaneously sampled, converted to digital form and presented to the digital computer. Accuracy of both conversion modes is 0.05% of full scale. For information write EPSCO, INC., 588 Commonwealth Ave., Boston 15, Mass.

Circle 184 on Reader Service Card.

DATAMATION *book capsules*

HIGH-SPEED DATA PROCESSING by C. C. Gotlieb and J. N. P. Hume, 1958, McGraw-Hill Publishing Co., 327 W. 41st St., N. Y. 36, N. Y., 305 pp., 83 illus., $9.50.

The principles and general techniques of processing data at high speeds, particularly for business purposes, are outlined in this book. It covers a wide range of subjects, from the method of representing information in a processor to advances in automatic programming, and shows how data processors work, how they are used and what their advantages are.

The book does not deal with any particular machine but covers data processors of all types and from all manufacturers. To focus attention on the operational principles of all high-speed data processors, the book uses a hypothetical machine as a model. With scores of tables and illustrations, the book gives a detailed study of coding and programming, and provides several examples showing typical applications of high-speed data processing in the major fields.

The topics covered include an introduction to computer principles, representation of information, functional units, machine organization, the instruction code, analyzing, programming and coding, coding examples, files in data processing, and automatic programming.

PROCEEDINGS OF THE FOURTH ANNUAL COMPUTER APPLICATIONS SYMPOSIUM (October 24-25, 1957), 1958, Armour Research Foundation of Illinois Institute of Technology, MF:CA4, 10 W. 35th St., Chicago 16, Ill., 126 pp., $3.00.

The sessions of the Fourth Annual Computer Applications Symposium stressed new areas of application, use of new computers and accessories, and recent developments in automatic programming. As in previous years, the dual structure of the conference emphasized business and management applications on the first day and engineering and research applications on the second day. In the preface, it is pointed out that the implied distinction is by no means clear cut. Sharing of computer facilities by management and research interests characterizes many contemporary installations.

RESEARCH IN MACHINE TRANSLATION—Report of the Eighth Annual Round Table Meeting on Linguistics and Language Studies, edited by Leon E. Dostert, 1957, Georgetown Univ. Press, Washington, D. C., 193 pp., $2.25.

The increasing interest in machine translation of languages and the growing scope of research in this field in several countries justified a departure from the established pattern of the Round Table Meetings on Linguistics and Language Studies, according to Editor Dostert.

Chapter headings in the book include Systems of Logic in Machine Translation, Character Sensing as an Input to Machine Translation, Lexical Problems in Machine Translation, Scope of Syntactic Analysis in Machine Translation, and Practical Objectives in Machine Translation Research.

NOTES ON ANALOG-DIGITAL CONVERSION TECHNIQUES, edited by Alfred K. Susskind, five contributors, 1958, John Wiley and Sons, Inc., 440 Fourth Ave., N. Y. 16, N. Y. and Technology Press, M.I.T., 410 pp., $10.

The outgrowth of a special summer program on analog-digital conversion techniques held at M.I.T. late in 1957, this book offers a detailed exposition of both theory and design. The authors have stressed fundamental concepts and have expressed these concepts in quantative terms where possible. Inherent engineering limitations are taken into consideration and relative merits of various approaches are weighed.

The subject matter is divided into three parts. The first pertains to systems aspects of digital information processing that influence the specifications for analog-to-digital and digital-to-analog conversion devices. In the second part, a detailed engineering analysis and evaluation of a variety of conversion devices is presented. The third part is devoted to a case study based on development work done at the servomechanisms laboratory of the M.I.T. department of electrical engineering.

CIVIL ENGINEERING, the official magazine of the American Society of Civil Engineers, devoted its May 1958 issue to electronic computers. Copies are available for new subscribers. Address: 33 W. 39th St., New York 18, N. Y.

GRIN AND BEAR IT — **By Lichty**

"So it's loaded with scientific knowledge about meteorology, stratospheric physics and cloudistics! . . . But has it got the practical experience of looking out a window? . . ."

ICIP PLANNED FOR JUNE, '59

United States participation in the First International Conference on Information Processing was announced at the opening session of the Western Joint Computer Conference in Los Angeles on May 6. The first official announcement of the International Conference, sponsored by UNESCO (United Nations Educational, Scientific, and Cultural Organization), marked the recognition of information processing by automatic means as a universally accepted technology.

For the first time, representatives of many nations will convene for the purpose of advancing this technology for the benefit of mankind. The announcement was read in behalf of Isaac L. Auerbach of Auerbach Electronics Corporation, who is Chairman of the U.S. Committee for the International Conference on Information Processing.

Conference subjects will include methods of digital computing; logical design and common symbolic language for machines; automatic translation of languages; collection, storage and retrieval of information; and pattern recognition and machine learning. They will be treated in technical papers in the program of the meeting, scheduled for June 13 to 21, 1959 in either Paris or Rome, final decision to be forthcoming early this summer.

There will also be symposia (attended by only a limited number of specialists), dealing with certain special problems, such as the interrelationship of digital and analog computers, the control of errors in statistical data, development of low temperature memories, and water table computation.

One of the major aspects of the Conference will be an exhibition of machines and apparatus, accompanied by pertinent demonstrations and discussions. In addition, ancillary tours will be organized to convenient major European computer facilities.

It is estimated that several thousand participants will attend the conference. The number of papers accepted for discussion will be limited to assure representation in all of the topical areas.

ANNUAL ACM MEETING SET

On June 11, 12 and 13, the Thirteenth National Meeting of the Association for Computing Machinery will be held on the Urbana campus of the University of Illinois. Widespread interest in this meeting has necessitated reorganization of the program, which includes 27 sessions into parallel sessions to be held each morning and afternoon.

A limit of 15 minutes for contributed papers and 35 minutes for invited papers will be enforced by the session chairmen. Each paper will be followed by a five-minute discussion period.

A general session will open activities at 10 a.m. on Wednesday, June 11. It will be held for all delegates in the University auditorium.

Sessions slated for Wednesday afternoon are "Differential Equations I," "Computer Design," "Computer Applications," "Differential Equations II," "Computer Research in the University" (panel discussion) and "The Share 709 System."

On Thursday, these sessions will be offered: "Programming," "Matrix Computations and Programming Methods" (panel discussion), "Digital Computer Arithmetic," "Algebraic Translation," "Data Processing I," "Data Processing II," "Error Analysis," "Round-Off Error in Floating Point Arithmetic" (panel discussion), "Special Problems," "Satellite Computations," "Statistics: Sorting" and "Sorting" (panel discussion).

And these session are set for Friday: "Evaluation of Functions," "Algebraic Problems," "General Topics in Computing," "Language Translation," "Computer Logic," "Simulation," "Mathematical Methods" and "Report of the Educational Committee."

Registrants are invited to visit the University of Illinois digital computer laboratory at any time during the meeting. The ILLIAC computer will be operated on a 24-hour basis.

A cocktail party and banquet will be held on Thursday evening, June 12. Tickets will be available to preregistrants at $1.50 and $4.50, respectively.

FRANCE'S GAMMA 60
a step forward in data processing?


Philippe Dreyfus

One of the highlights of the Western Joint Computer Conference (Ambassador Hotel, Los Angeles, May 6-8) was an unscheduled event—a special session called on the evening of May 7 to give delegates an opportunity to be briefed on a new data processing system developed in France, the Gamma 60.

Speaking from notes, Philippe Dreyfus of the Bull Machine Co., Paris, described the operation and some of the applications of the system. Bull recently completed the design of Gamma. It will be in production by the middle of next year. Cost of the unit is in the $1½ million category.

Gamma 60 will become best known for its flexibility, according to Dreyfus. Other notable features claimed by the manufacturer are: (1) the machine's capability for simultaneously handling several programs without any relationship existing between these programs; (2) its ability to handle "mixed data" input where the various word lengths differ both in size and format; (3) the fact that raw data distribution is automatically programmed internally rather than with external plugboards.

Dreyfus pointed out that the company has adopted the word "catene"—meaning a connected series—in lieu of the usual computer term "word." The catene, which contains 24 bits, may represent either six decimal digits or four alpha characters.

Gamma's logical designers were Pierre Chanus, Jean Bosset and J. P. Cottet. Responsible for equipment design were Henri Feissel and Bruno Laclarc. The systems engineering was handled by Dreyfus.

A detailed report on the Gamma 60 is contained in the following article obtained and translated by DATAmation after Dreyfus' conference address.

Gamma 60, A Description

The powerful electronic data processing system designated as "GAMMA 60" is composed of a central unit to which are connected functional elements and input and output devices whose number is theoretically unlimited.

A. Central Unit and Functional Elements

GAMMA 60's main characteristic is the distribution of all functions between several distinct units. Each unit enjoys a certain autonomy: it has ranges of operation and an internal program allowing it to work independently from other units.

These units are not directly connected: each is linked through its own input-output connection to the central unit which performs and coordinates the transfers.

a) Central Unit. The central unit is composed of: (1) A quick memory; (2) A program unit.

The quick memory is a magnetic core device composed of one to eight blocks, each with a capacity of 98,304 bits. Input or out catenes consist of 24 binary bits each.

A quick memory block has a capacity of 4,096 catenes. Therefore the total quick memory capacity is 32,768 catenes. The memory access time is 11 microseconds.

One single numeric figure occupies 4 binary positions, one alpha letter occupies 6 of them. The catene's capacity is then 6 digits or 4 alpha characters and the capacity of a quick memory block is 24,576 numeric, or 16,384 alpha characters.

The program unit routes the quick memory's output to the various computer elements concerned. This unit's particular object is: First, to coordinate the command circuits handling the different elements. Second, to perform automatically certain instruction computations: (1) a special indicator makes it possible to indicate in an instruction the magnitude or symbol upon which a mathematical operation is performed, its address and the address of its address; (2) the conversion of the related addresses into the finished product allows the automatic transposition of programs and sub-programs; (3) a control circuit makes possible the automatic return to the main program after the execution of a sub-program.

b) Elements Connected to the Central Unit. The elements connected to the central unit are as follows:

A general comparator whose special function is to compare two alpha-numerical blocks of data of any length. It performs manipulations such as location, classifying and inter-classifying without bringing to a stop other functional elements.

A logical computer which performs the binary and logical operations. This is used, first, for qualitative data analysis (selection interdependences, complex conditioning), secondly, to handle instruction computations.

An arithmetic computer which executes the usual arithmetic computations upon algebra decimal numbers of 12 figures with fixed point, or upon 10 significant and 2 exponent figures with floating point. In addition, a subtraction or a comparison requires 50 microseconds for fixed point, and 100 microseconds for floating point computations.

A 300 microsecond time of execution is required for the performance of a multiplication.

Internal parity checking insures the accuracy of all arithmetic computations.

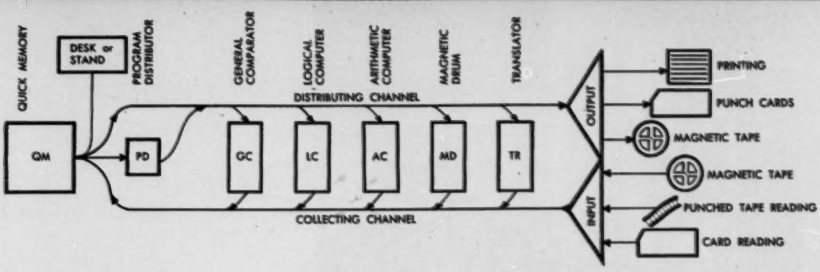
One or several Magnetic Drums. The magnetic drum's characteristics are as follows: (1) Capacity: 786,432 binary digits representing 196,608 figures or 131,072 alphanumerical characters. (2) Access time: maximum 22 milliseconds, average 11 milliseconds.

Transfers between drums and quick memory are done through any catene number by indicating the original addresses contained in the transmitter and receiver as well as the number of catenes to be transferred.

A translator acting as a link between the functional elements (computation, comparing) and the input and output devices.

At the input, this unit gathers data as figured on the

GENERAL DIAGRAM: PRINCIPLE OF GAMMA 60



originating media (punched cards, perforated tape, magnetic tape) as they are handled by the reading device. They are selected according to the reading program and are translated into machine language.

At the output, it selects data produced by the computing elements, arranges them according to the negatives' pattern or the set-up required and programs it in code and format.

B. Input and Output Devices

The input and output devices are directly connected to the central unit of GAMMA 60, the former to the collecting channel, and the latter to the distribution channel.

1) Card readers—3 reading stations, 2 reception compartments, 300 cards per minute.
2) Perforated tape readers—600 characters per second.
3) Card punch readers — 1 perforation station, 3 reading stations, 1 of which after punching is done, 2 reception compartments, 300 cards per minute.
4) Tape punch perforators—25 characters per second.
5) Magnetic tape unit—writing while tape's unwinding; reading, both while winding and unwinding; quick re-winding, 8 data channels, automatic elimination of imperfect tape zones; speed, 30,000 numeric or 20,000 alpha characters per second. Capacity per reel: 7,500,000 numeric or 5,000,000 alpha characters.
6) Printing—120 positions, 60 characters per position, 300 lines per minute. Spacing and skipping is directed through the program.

Because of the way this unit is set-up and conceived it will be easy to plan in the future a connection to other input, output organs of different nature and performance.

Gamma 60 Operation

Quick memory

The quick memory is the link between the different elements of GAMMA 60. It is used for multiple purposes and may contain, for instance: (a) raw data transmitted through the input devices and intended for the translator; (b) translated data intended for the functional elements; (c) intermediate results; (d) data intended for a magnetic drum or originating from a magnetic drum; (e) results translated and intended for the output devices; (f) pending program instructions.

All quick memory addresses are stereotyped. Consequently, they may be used for any one of these functions without discrimination.

Control

Internal key devices control transfers and arithmetic computations.

The input and output devices which cannot be key controlled (input of fresh data, for instance) are controlled through double introduction or double extraction.

The detection of an error through the internal control device may either bring the machine to a full stop or start a sub-program of renewal allowing a repetition of computations in the frame of a set-up of automatic error correction.

Simultaneous operation

The systematic use of quick memory as a go-between the elements, the elements' autonomy once they are fed into instructions, the part the distribution and coordination plays on the program distributor, make it possible for all elements to operate simultaneously.

This particular and original point affords a fundamental advantage to GAMMA 60, it being the simultaneous performance of several functions such as: (1) input; (2) output; (3) translations; (4) arithmetic computations; (5) logical computations; (6) indicative comparison; (7) drum transfers.

This advantage may be used: (a) to increase quite notably the performance of determined tasks through the simultaneous execution of several functions and by multiplying the elements which constitute this work's bottleneck. (b) to handle simultaneously several distinct tasks.

In this manner this machine's set-up allows the control (through programs all of which are recorded) of all phases of data manipulation.

Consequently, GAMMA 60 can be used with different set-ups according to the kind of work required, for instance:

1) raw data is fed directly starting with the cards, the computation is made and the results directly printed at the same time as they are recorded on the magnetic tape unit.

2) raw data from cards is transferred to magnetic tape, this tape being handled at the same time as permanent and semi-permanent information, and a single magnetic tape is made containing the results to be printed: later, this tape can feed one or several printers.

Programming

Systematic methods of analyzing problems have been developed for evolving computer programs.

Together with the equipment, a complete program library is furnished, comprising particularly:

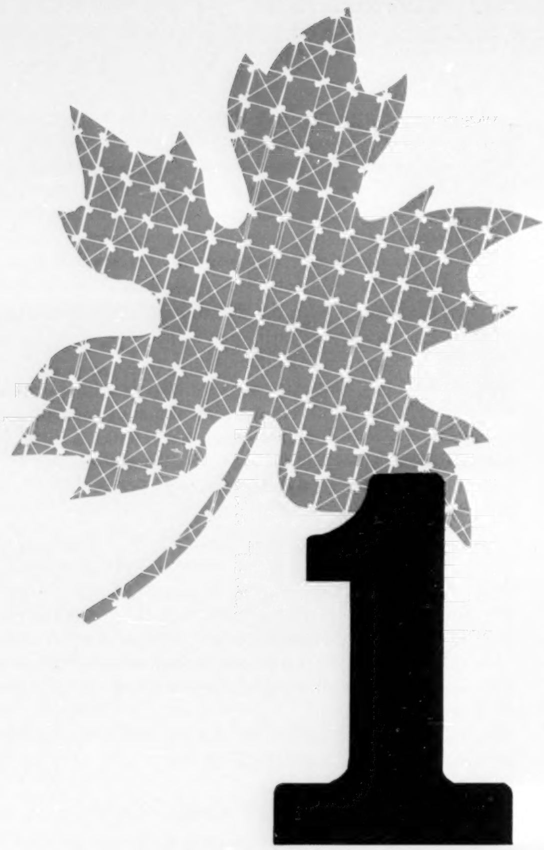
1) The sub-routine corresponding to each analytical stage in the program as well as other sub-routine, such as quick memory sorting, tape sorting, interclassification, table lookup, etc.

2) Sub-routines of sine functions, cosine, tangent, logarithm, sine arc, cosine arc, tangent arc, ex, ax, 10x, square root of x, or matrix computation, etc.

3) A program analysis to arrange various programs.

4) A program to translate symbol codes into machine codes.

Further information may be obtained by contacting Campagnie des Machines Bull, 94 Ave. Gambetta, Paris 20, France.



FIRST CANADIAN CONFERENCE FOR COMPUTING AND DATA PROCESSING CONCLUDED

sessions held june 9, 10 at university of toronto

Since 1956 there has been a sharp increase in the number of Canadian companies committing themselves to computers and data processors. Even though Canadians interested in this field regularly attend meetings sponsored by societies in this country and in Europe, there has been a growing feeling that there are problems especially important to Canadians, and that these are sufficient in number to warrant a national conference.

For example, Canadian tax, legal and financial practices are different from those in the U. S., the wide dispersion of Canadian centers of activity pose special problems and the relatively few people engaged in this field make it especially important to achieve some kind of liason between the scientific and business groups. A spokesman for one U. S. manufacturer agreed that the dispersion of data processing activity in Canada is indeed a problem. He pointed out that, except for a few metropolitan areas, the country's population is widely scattered and if the entire population is to be served by computers, the centers have to be placed accordingly. He pointed out that under these conditions, it is often difficult to put a product before a sufficient number of purchasers. Then there is the problem of communication between different units in a given system after installation.

On the positive side, another manufacturer pointed out that a larger market is developing in Canada because of her impressive technological advances. Cited as examples of potential users of data processing equipment were companies involved in the booming automotive, aircraft and metals industries in Canada.

The concept for this Canadian conference was formed when the nucleus of a committee was organized and a preliminary survey showed that there was indeed a general interest in such a gathering. The nucleus was then expanded to two committees, the Executive and Program committees.

The Executive Committee is comprised of co-chairmen A. O. Downing and F. P. Thomas, secretary H. J. Stowe, treasurer H. W. Rowlands, program committee chairman C. C. Gotlieb and publicity chairmen L. E. Sanford, A. G. Barclay, R. L. Martino and K. S. Moeser.

Members of the Program Committee include J. H. Aitchison, H. S. Gellman, G. Glinski, T. Hull, J. Kates, J. M. Kennedy, H. O. McNutt, E. A. Racicot, D. Ritchie, N. P. Shevloff, R. G. Stitt, D. B. Watson and A. L. Wright.

There were 36 papers presented by members of Canada's business, industrial, government and educational organizations. These papers were delivered in nine sessions, some of which were parallel (see schedule, following page). All sessions were held in the McLennan Laboratory on the University of Toronto campus.

The welcoming address was delivered by F. P. Thomas, conference co-chairman and the opening address was given by W. H. Watson, director of the computer center at the University of Toronto. A complete copy of the Conference Proceedings, containing a full reprint of the papers delivered, will be mailed to registrants shortly.

conference program

Monday, June 9th

SESSION I: CANADIAN PROBLEMS.

Chairman: J. Aitchison, IBM.

Welcome: F. P. Thomas, Co-chairman Canadian Conference for Computing and Data Processing.

Opening address: W. H. Watson, Director Computation Centre, University of Toronto.

Paper 1 — 40 minutes.

"THE COMPUTER IN CANADIAN RAILROADING: C.P.R. SYSTEM-WIDE DATA PROCESSING." H. C. Reid, Canadian Pacific Railways.

Paper 2 — 30 minutes.

"CRYSTAL BALLS OR MAGNETIC CORES—THE APPLICATION OF COMPUTERS TO CANADIAN BUSINESS FORECASTING." W. Allan Becket, University of Toronto.

Paper 3 — 30 minutes.

"COMPUTER EDUCATION IN CANADIAN UNIVERSITIES." George S. Glinski, ElectroData.

SESSION II. SYSTEM ORGANIZATION.

Chairman: G. Stitt, Confederation Life Association.

Paper 4 — 40 minutes.

"PLANNING A DATA PROCESSING SYSTEM." H. O. McNutt, Imperial Oil Limited.

Paper 5 — 40 minutes.

"THE POTENTIAL OF LARGE SCALE ELECTRONIC SYSTEM IN THE LIFE INSURANCE INDUSTRY." J. C. Davidson, Confederation Life Association.

Paper 6 — 40 minutes.

"JUSTIFYING ELECTRONIC DATA PROCESSING IN GOVERNMENT SERVICE." H. E. Baird, Civil Service Commission.

Paper 7 — 40 minutes.

"DATA PROCESSING AT THE CANADIAN NATIONAL RAILWAYS." A. A. Mackey, Canadian National Railways.

SESSION III: SCIENTIFIC AND ENGINEERING APPLICATIONS, I.

Chairman: H. S. Gellman, H. S. Gellman & Co. Ltd.

Paper 8 — 40 minutes.

"SOME MATHEMATICAL AND PROGRAMMING PROBLEMS ENCOUNTERED IN THE OPERATION OF A SCIENTIFIC COMPUTING FACILITY." J. L. Howland, K. M. Smillie, Computing Devices of Canada, Ltd.

Paper 9 — 40 minutes.

"SOME AUTOMATIC COMPUTING ASPECTS IN THE EVALUATION OF AIRCRAFT PERFORMANCE." R. Harvey, Canadair Ltd.

Paper 10 — 40 minutes.

"ARROW FLIGHT TEST DATA EDUCATION." A. Cohen, Avro Aircraft Ltd.

F. P. Thomas
co-chairman
Power Commission

A. O. Downing
co-chairman
A. V. Roe, Ltd.

H. J. Stowe
secretary
Manufacturers Life

H. W. Rowlands
treasurer
Woods and Gordon

K. S. Moeser
publicity
IBM, Ltd.

A. G. Barclay
publicity
KCS Data Control

C. C. Gotlieb
program
Univ./Toronto

R. L. Martino
publicity
RemRand, Ltd.

Paper 11 — 40 minutes.
"SURVEYING APPLICATIONS FOR THE E101." J. R. Holmes, ElectroData Division, Burroughs.

SESSION IV: FUNDAMENTALS OF COMPUTERS AND DATA PROCESSORS.
Chairman: D. Ritchie, Ferranti Electric Ltd.

Paper 12 — 40 minutes.
"CHARACTER REPRESENTATION AND STORAGE SYSTEMS." R. F. Johnston, Adalia Ltd.

Paper 13 — 40 minutes.
"ARITHMETIC AND CONTROL UNITS." F. M. Longstaff, Ferranti Electric Ltd.

Paper 14 — 40 minutes.
"INPUT-OUTPUT and AUXILIARIES." E. A. Racicot, Remington Rand Ltd.

Paper 15 — 40 minutes.
"ELEMENTS OF PROGRAMMING." C. R. Maheux,

Reception and Banquet at King Edward Hotel.

CONFERENCE PROGRAMME

Tuesday, June 10th

SESSION V: BUSINESS DATA PROCESSING.
Chairman: A. L. Wright, Manufacturers Life Insurance.

Paper 16 — 40 minutes.
"AN APPROACH TO A BANKING APPLICATION." W. R. Wade, ElectroData Division, Burroughs.

Paper 17 — 40 minutes
"APPLICATIONS IN INDUSTRY FOR A MEDIUM-SIZE COMPUTER." O. M. Mackey, Canadian General Electric Co. Ltd.

Paper 18 — 25 minutes.
"COMPUTER INPUT—A BY-PRODUCT OF FORM WRITING." J. H. Crossan, Underwood Ltd.

Paper 19 — 25 minutes.
"FORM DESIGN, CONSTRUCTION AND PAPER HANDLING PROBLEMS AS RELATED TO HIGH SPEED PRINTERS." R. H. Allen, Moore Business Forms Ltd.

Paper 20 — 25 minutes.
"THE USE OF A MEDIUM-SIZE COMPUTER IN RETIREMENT AND WELFARE PLAN ADMINISTRATION." Wm. R. Read, Marsh and McLennan.

SESSION VI: SCIENTIFIC MANAGEMENT.
Chairman: J. Kates, KCS. Data Control Ltd.

Paper 21 — 40 minutes.
"A COMPUTER PROGRAM FOR SYSTEM OPTIMIZATION." J. R. Dickinson, Canadian General Electric Co.

Paper 22 — 40 minutes.
"APPLICATIONS OF A SMALL STORED PROGRAM COMPUTER IN OIL PIPELINE OPERATIONS." I. Switzer, The McBee Ltd.

Paper 23 — 40 minutes.
"OPERATIONS RESEARCH AND COMPUTER IN AN INTEGRATED OIL COMPANY." E. E. Sorensen, The British American Oil Co. Ltd.; H. V. Fullerton, K. C. S. Data Control Ltd.

Paper 24 — 40 minutes.
"THE USE OF COMPUTERS IN WEAPONS SYSTEMS ANALYSIS AND DESIGN." R. A. Nodwell, K. J. Radford, Royal Canadian Air Force.

SESSION VII: ENTERING THE COMPUTER FIELD.
Chairman: D. B. Watson, J. D. Woods and Gordon Ltd.

Paper 25 — 40 minutes.
"CONDUCTING A FEASIBILITY STUDY—A CASE HISTORY." F. P. Thomas, Hydro Electric Power Commission of Ontario.

Paper 26 — 40 minutes.
"SITE PREPARATION AND CHANGEOVER PROBLEMS." C. C. Dumbrille, DuPont Company of Canada (1956) Ltd.

Paper 27 — 40 minutes.
"OPERATING CONSIDERATIONS." J. N. P. Hume, University of Toronto.

Paper 28 — 40 minutes.
"DATA PROCESSING INSTALLATIONS IN CANADA." H. W. Rowlands, J. D. Woods & Gordon Ltd.

SESSION VIII: SCIENTIFIC AND ENGINEERING APPLICATIONS, 2.
Chairman: N. P. Shevloff, Canadair Ltd.

Paper 29 — 25 minutes.
"SELF-CONSISTENT FIELD CALCULATIONS." B. H. Worsley, University of Toronto; J. F. Hart, National Research Council.

Paper 30 — 25 minutes.
"APPLICATION OF DIGITAL COMPUTERS TO THE DETERMINATION OF CRYSTAL STRUCTURES BY X-RAY ANALYSIS." F. R. Ahmed, National Research Council of Canada.

Paper 31 — 25 minutes.
"ELECTRONIC COMPUTERS AND THE ONTARIO DEPARTMENT OF HIGHWAYS." A. E. Goodwin, Ontario Department of Highways.

Paper 32 — 40 minutes.
"SOME APPLICATIONS OF AN ELECTRONIC COMPUTER TO PROBLEMS OF DIFFUSION." J. M. Kennedy, E. A. Okazaki, R. M. Pearce, Atomic Energy of Canada Ltd.

SESSION IX: PROGRAMMING METHODS.
Chairman: C. C. Gotlieb, University of Toronto.

Paper 33 — 40 minutes.
"SHORTHAND FOR COMPUTERS." R. L. Martino, Remington Rand Ltd.

Paper 34 — 40 minutes.
"FORTRANSIT — A UNIVERSAL AUTOMATIC CODING SYSTEM." B. C. Borden.

Paper 35 — 40 minutes.
"ORGANIZATION OF LARGE-SCALE MATRIX CALCULATIONS." S. H. Cohn, R. M. Ohora, Avro Aircraft Ltd.

Paper 36 — 40 minutes.
"EXPERIENCE OF THE DEFENCE RESEARCH BOARD OF CANADA IN MAIL ORDER COMPUTER SERVICE." W. Fraser, Defence Research Board.

DATAMATION *on campus*

OHIO STATE, UW GET DATA REDUCTION CENTERS

Data Reduction Centers at the University of Wisconsin and Ohio State University will be established under terms of a Federal contract offered and accepted by both universities early in May to relate and interpret scientific observations made in Antarctica during the International Geophysical Year. The two schools were named by the National Academy of Sciences' IGY Committee to operate data reduction installations. Funds amounting to $86,820 will be furnished by the National Science Foundation. Work on each campus will cover gravity, magnetic, and seismic observations made by American parties in Antarctica and similar observations to be carried out by U. S. scientists during 1958-59. Professor George P. Woollard, who directs UW geophysics studies, heads the new office at his school. The agency at Ohio is under the direction of Dr. Richard Goldthwait.

CASE INSTITUTE COMPUTER CENTER DEDICATED

Outstanding leaders in industry and research spoke at the dedication of the Case Institute of Technology computing center in Cleveland at special ceremonies on April 12. Spectators at the dedication of the $2,500,000 center, heard addresses by Marcell Rand, executive vice-president of Remington Rand; J. J. Bricker, vice-president of IBM; Dr. Englehardt Eckhardt, assistant director, National Science Foundation; John E. Kusic, vice-president of the Chesapeake and Ohio; Dr. T. Keith Glennan, president of Case; and Dr. Raymond J. Nelson, director of the computing center. The new installation contains a Univac I and an IBM 650.

NORTHWESTERN PROJECTS IN FULL SWING

Another new computing center is now in operation at Northwestern University, Evanston. Here, too, an IBM 650 is the heart of the center. University officials claim that Northwestern is one of the first education institutions in the Chicago area with a computer of this size. Some 25 research projects, prepared by the faculty and graduate students, are being processed. The computer will also be used for research and instruction on the undergraduate level. Dr. Kaj Aa. Strand, director of the Dearborn Observatory, directs center operations.

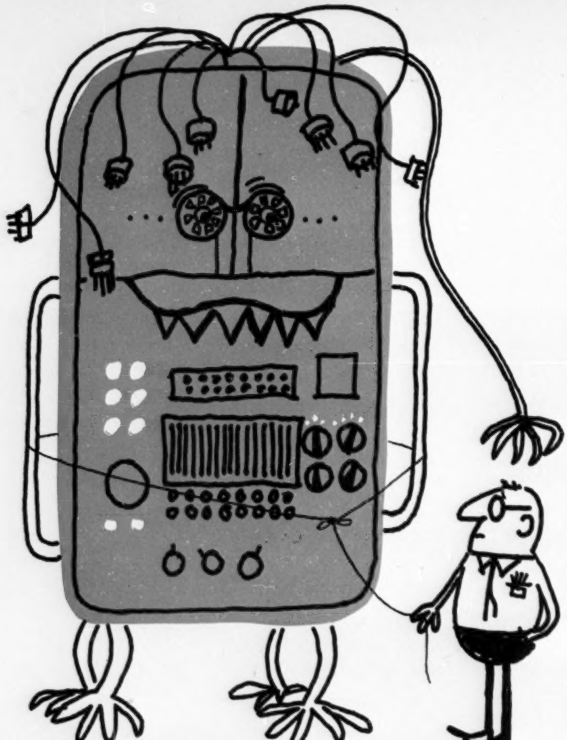
TERM CLOSES— DATA WORK GOES ON

The closing of the spring term will not bring data processing activities on U. S. campuses to a halt. Some cases in point: At the University of Michigan, intensive courses in computer science and engineering will be held from June 16 to 27. Some course titles—Introduction to Digital Computer Engineering, Computer Programming and Artificial Intelligence, Business-Type Data Processing: Recent Development and Future Trends. Fifteen courses in all. Costs per course—$150 to $225. . . . Pennsylvania State University will offer engineers and scientists a seminar on automatic controls from August 3 to 8. It will begin with a presentation of basic principles of feed-back control and analog computation. This to be followed by a series of case studies. . . . The Fifth Annual Symposium on Computers and Data Processing will be held at the University of Denver on July 24 and 25. Stressed will be the need for more intensive support of fundamental research in this field.

MICHIGAN STATE COMPUTER CAN SING

Music has been heard at one school's data processing center. Michigan State U.'s computer, MISTIC, now plays "Waltzing Mathilda." The special tape that causes MISTIC to "sing" the Australian Army song was given to MSU by operators of MISTIC's sister computer at the University of Sydney. The music vaguely resembles that of a group of bagpipes. It is made by the computer's audible signals which indicate how the machine is functioning.

SIMPLICITY AND THE COMPUTER
bendix offers a short cut to instruction, operation



by ROBERT N. GOLDMAN

Too many people think that a computer is a complex, diabolical device; a machine that can be used and controlled only by trained specialists of high IQ. Their attitude is quite satisfying to the ego of those of us who work with computers. But it is quite unsatisfactory to many firms which are considering the use of computers.

The purchaser of a large computer can afford to have professional programmers, but often a would-be purchaser of a low-cost computer will be a purchaser only if the personnel already in his employ can program and operate the machine.

How can we convince people that the small computer is operable by an average person? The trouble is, the people who hold the complex, diabolical view are often right; one way to convince them then would be to actually make the computer easy to use.

Look at the instruction manual that accompanies many a modern computer and you will find that its author blithely assumes his readers have had a rather strange background —that they were educated perhaps on Mars or Venus but certainly not Earth. He assumes that they count and do arithmetic in some non-decimal system; he assumes that in their everyday life they have learned to shift decimal points in numbers not yet known so that they may be combined in proper arithmetic fashion with other numbers not yet known; then he airily dismisses how to keep each result of these arithmetic operations under a value of one, as being hardly worth discussing. And after the reader has been taught his lesson in humility he may find at the end of the book, intricate plugboard wiring diagrams which he must try to understand.

In the early days of computers a tempting way to overcome the hurdle of a complicated operating manual was either not to prepare one or to keep it under cover until the computer was acquired by the customer. Today, however, prospective customers are wary of this tactic.

What are the features which would make a computer a simpler instrument with which to work?

The most important is that numbers be handled in the form with which most people are familiar. The decimal number system should be used. It should not be necessary to constantly shift the locations of decimal points in numbers so that they may be entered into the computer, or to program a decimal point shift so that numbers may be combined in internal computation; and when data is read out of the computer the decimal points in numbers should occur in the places where people expect to see them. It should not be necessary in programming to artificially force the result of every arithmetic operation to be less than one because the computer can't handle numbers of greater value.

Moreover, the commands by which the computer is programmed should be straight forward and not require legal training to follow intricacies and exceptions to the rules.

There are other features which would be nice to have, but common sense seems to dictate at least the ones above as basic.

One way of achieving programming simplicity would be to build it into the hardware. The command structure could be made simple and the number of commands limited. The computer could be made a basically decimal machine; and an automatically adjusted decimal point for numerical data could be built into the design.

Unfortunately, these features are expensive. They call for a sizeable increase in quantity of hardware unless other features, features which make a computer really useful, are sacrificed.

Though we want an easy way to use small computers, we also want to have a completely general purpose computer—one which is internally programmed and can modify its own program, one in which a set of commands can automatically operate on different sets of data; one which can incorporate subroutines for even further programming simplification; one in which programs are easily checked or debugged; and one which provides facilities for an assortment of input-output devices.

By increasing the amount of hardware we are confronted with either an unduly expensive machine or a reasonably priced device of limited utility.

Let us then look for an alternative approach to achieving programming simplicity.

For years computer manufacturers have promoted and extolled the abilities of their machines to do all types of routine calculating and decision making operations. Why,

instead of talking so much about what computers could do for others, did they not look in their own backyards and program computers to do the routine work of programming? With this slightly embarrassing question, first asked some time ago, the trend toward self-programming techniques was begun. It is an approach to programming simplicity new to small computers but used extensively in large computers since it permits the retention of versatility without an increase in equipment cost or size.

Self-programming methods fall under various classifications of which two basic ones are "interpreters" and "compilers." A compiler is a computer routine which accepts simplified instructions, transforms each simplified instruction into one or more machine language commands, and assembles the results into a machine language program. The final program which may be put on punched tape or punched cards or magnetic tape, may then be re-entered into the computer and executed.

The system is ingenious but two difficulties immediately arise. Programming has been simplified but operating procedure has been made more complicated as two stages are now required—in the first, which uses the compiler, the machine language program is prepared; in the second, the program is executed. A resulting difficulty is that of program debugging; how can programming errors be found which were made in writing the simplified program? The user can't debug his machine language program on the computer because he doesn't understand it; only the machine does. If supplementary techniques and routines are devised for the purpose, computer operating procedures become still more complicated and still harder to follow. In the attempt to attain simplicity, simplicity has been lost.

Consider then the interpreter. Interpretive routines are those in which the simplified instructions are stored internally just like machine language commands; when the machine reads an interpretive instruction stored in its memory, it obeys a group of machine language instructions specified by the interpretive one. In other words, the effect of the interpreter is similar to that of adding hardware to the computer; the additional features instead of being added in the form of diodes, transistors or tubes are added in the form of machine language instructions placed in the computer's memory.

Only one operating step is necessary. With a properly designed interpreter, programming errors can be isolated easily; interpretive commands in the program can be executed individually in order to study their effects.

With ease of use as the criterion an interpreter would

A portion of an Intercom program is shown below for the calculation of

$$\sin \sqrt{\frac{a + bc}{d}}$$

where a, b, c and d are stored at memory addresses 1100, 1101, 1102 and 1103, respectively. Each operation is performed on the contents of an arithmetic register called the accumulator and the result of the operation appears in the accumulator.

Description	*Command* Command Code	Address
1. Clear accumulator and add b	42	1101
2. Multiply b, in accumulator, by c	44	1102
3. Add bc, in accumulator, to a	43	1100
4. Divide a + bc, in accumulator, by d	48	1103
5. Perform square root subroutine which begins at address 1442 and leave result in accumulator	08	1442
6. Perform sine subroutine which begins at address 1597 and leave result in accumulator	08	1597

After Step 6 is performed the answer is in the accumulator and may be read out of the computer, stored in the memory or used in further computation.

seem to be a better choice than a compiler. But can an interpreter for a low-cost computer be both truly simple and versatile?

The problem here is that a really good interpreter should be more difficult to design for a low-cost computer than for a large scale computer because of the difference in speed of computation and in flexibility of command structure between the two machines.

But there is a small computer—the Bendix G-15—which has the command flexibility of a large scale machine coupled with a computing speed unusually high in the low-cost field.

This is the general background which led to the development of an unusual interpretive programming system for the Bendix G-15 Computer; one designed to be completely self-contained and to put powerful computing facilities at the disposal of non-specialists. The new interpreter has been given the esoteric name, Intercom 1000.

Intercom 1000 provides the features which were stated earlier to be necessary to make a computer a simple instrument with which to work, but it is also a general purpose computing system in which commands and data may be stored interchangeably in the computer's memory.

During input and output, numbers are written in their familiar form. The number 314.16, for example, is expressed 314.16; there is no need to re-adjust decimal points. However, internally numbers exist in floating point form; therefore, numbers need not be internally shifted for arithmetic operations, and the programmer need not concern himself with numbers too large or too small during computation.

The commands are simple. In general, each expresses an operation to be performed and an address in the computer's memory where the data to be used in the operation has been stored. A portion of a program is shown in the accompanying figure on the previous page.

The illustrated program uses but a few of the available commands. There are commands for conditional transfer of control based on a variety of conditions; also, commands for punched tape, punched card, magnetic tape and typewriter input-output. Index registers permit a set of commands to automatically operate on different sets of data stored in the memory. Accuracy of computation may be to twelve significant figures.

Operating ease has been retained. No plugboards are involved in the system. A program can be executed one command at a time or manually changed during execution. All the information that is necessary to operate the computer, to read information into and out of the computer, to prepare programs, and to check them out on the computer, is contained in a single, compact manual.

Intercom 1000 combines for the first time in a low-cost computer, the power of internally programmed computation with real ease of use. It represents another milestone in which we in the computer field can take pride.

Circle 104 on Reader Service Card.

Circle 8 on Reader Service Card.

Important dates in DATAMATION

June 8, 9: *Canadian Computer Conference*, University of Toronto. Contact H. J. Stowe, Manufacturers Life Insurance Co., 200 Bloor St., E., Toronto 5, Ontario, Canada.

June 9-11: *American Rocket Society Astronautical Exposition*, Hotel Statler, Los Angeles, Calif.

June 9-13: *Fourth International Automation Congress and Exposition*, Coliseum, N. Y., N. Y. Contact Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

June 11-13: *Association for Computing Machinery National Conference*, University of Illinois, Urbana, Ill.

June 12-13: *Systems and Procedures Conference*, Roosevelt University, Chicago. Contact Dean of Business Admin., Roosevelt Univ., 430 S. Michigan Ave., Chicago 5, Ill.

June 12-14: *Ninth Annual Conference, American Institute of Industrial Engineers*, Hotel Statler, Los Angeles. Theme: "Industrial Engineering–Gateway to Productivity." Contact Stanley Wolfberg, 1409 Thayer Ave., Los Angeles 24, California.

June 16-18: *Second National Convention on Military Electronics*, Sheraton Park Hotel, Washington, D. C. Sponsored by IRE and PGMIL.

June 18-20: *National Machine Accountants Association Seventh Annual Conference and Business Show*, Chalfonte-Haddon Hall, Atlantic City. Contact NMAA, Garden State Chapter, 259 Clifton Ave., Newark, N. J.

June 22-27: *Engineering Seminar*, Pennsylvania State University. Theme: "Utilization of Digital Computers in the Design of Electrical Equipment."

June 22-27: *Summer General Meeting and Air Transportation Conference of the American Institute of Electrical Engineers*, Buffalo, N. Y. Contact Raymond C. Mayer and Associates, 36 W. 46th St., New York 36, N. Y.

July 24, 25: *Fifth Annual Symposium on Computers and Data Processing*, University of Denver. Contact C. A. Hedberg, Electronics Division, Denver Research Institute, University Park, Denver 10, Colo.

August 6-8: *Conference on Non-Linear Magnetics and Magnetic Amplifiers*, Hotel Statler, Los Angeles. Sponsored by AIEE. Contact G. C. Anderson, AIEE Publicity Committee, P. O. Box 2025, Downey, Calif.

August 19-22: *Western Electronic Show and Convention*, Pan Pacific Auditorium, Los Angeles. Sponsored by IRE and WCEMA. Contact Don Larson, Business Manager, 1435 S. La Cienega Blvd., Los Angeles 35, Calif.

Sept. 15-19: *Thirteenth Annual Instrument-Automation Conference and Exhibit (International)*, Philadelphia Convention Hall, Phila., Penna. Sponsored by ISA. Contact J. F. Tabery, 3443 S. Hill St., Los Angeles 7, Calif.

Oct. 13-15: *International Systems Meeting*, "Only Major U. S. Conference Devoted Exclusively to the Systems Field," Penn-Sheraton Hotel, Pittsburgh, Penna.

Oct. 13-17: *Civil Engineering Show*, Hotel Statler, New York, New York.

Oct. 20-24: *National Business Show*, Coliseum, N.Y.C. Contact Rudolph Lang, Managing Director, 530 5th Ave., N. Y. 36, N. Y.

Oct. 23-25: *National Simulation Conference*, Dallas. Sponsored by IRE. Contact L. B. Wadel, 3905 Centenary Drive, Dallas, Texas.

Oct. 27, 28: *Fifth Annual East Coast Conference on Aeronautical and Navigational Electronics*, Lord Baltimore Hotel, Baltimore. Sponsored by IRE. Contact Harry Rutstein, Publicity Chairman, Lord Baltimore Hotel, Baltimore, Md.

Oct. 29, 30: *Fifth Annual Computer Applications Symposium*, Morrison Hotel, Chicago. Sponsored by the Armour Research Foundation, Illinois Institute of Technology. Contact the Foundation at 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Oct. 30, 31: *Fourth Electronic Business Systems Conference*, Olympic Hotel, Seattle. Sponsored by the western division of the NMAA. Contact E. B. S. Conference, NMAA, Western Division, P. O. Box 134, Seattle 11, Washington.

Dec. 3-5: *Eastern Joint Computer Conference*, Bellevue-Stratford Hotel, Philadelphia, Penna.

new DATAMATION literature

PORTABLE COMPUTER: A fully illustrated eight-page brochure describing model MC-400 desk-side analog computer is now available. A large illustration shows the free-rolling castered cabinet and clearly indicates the 16 scale-factor potentiometers, precision servo multiplier, true overload alarm, monitor and control panel, vacuum-tube voltmeter, complete programming patchboard, and other features which are standard equipment. The brochure gives a detailed description of the operational amplifiers and other standard and optional equipment, including removable patchboards, three-way amplifiers, extra operational and computing elements and special servo equipment. For copy write MID-CENTURY INSTRUMATIC CORP., 611 Broadway, N. Y. 12, N. Y.

Circle 200 on Reader Service Card.

TAPE PERFORATOR: Model GP-2 is completely described in this 14-page technical paper. Six large detailed drawings are included. Perforator timing, the tape feed system, the tape punch system, chad disposal, basic push-pull electromagnetics, synchronization of actuating signals and actuating circuit requirements—all these subjects are covered. A complete page is devoted to the perforator's characteristics. For copy write SOROBAN ENGINEERING, INC., Box 1717, Melbourne, Fla.

Circle 201 on Reader Service Card.

TAPE PUNCH, TAPE READER: In this eight-page booklet may be found a complete description and the details of operation of both of the above units together with pictures and drawings (with each part identified) of the punching mechanism and tape sensing mechanism. Technical data and specifications for both units are fully covered on two pages of the booklet's pages. Dimensions, weight, input connections and other characteristics are given. For copy write TELETYPE CORP., 4100 Fullerton Ave., Chicago 39, Illinois.

Circle 202 on Reader Service Card.

RAPID-ACCESS MAGAZINE: Bulletin 1598B describes a new rapid-access magazine which attaches directly to any of the manufacturer's type 5-119 recording oscillograph providing developed and dried oscillograph records concurrent with recording operation. Text and pictures explain the system design, complete record and Datarite operation. Operating and ordering specifications are presented on page four. For copy write CONSOLIDATED ELECTRODYNAMICS CORP., 300 N. Sierra Madre Villa, Pasadena, Calif.

Circle 203 on Reader Service Card.

POWER SUPPLIES: Release GEC-1514 describes transistorized dc power supplies developed for laboratory and testing applications and for use in computer power supply systems. This description covers the series-regulated type of power supply. Applications, technical information, availability, special features and future designs are included. For copy write GENERAL ELECTRIC CO., Rectifier Dept., Lynchburg, Va.

Circle 204 on Reader Service Card.

DATA PROCESSING SYSTEM: Two pages of features, facts and figures are contained in this four-page folder which describes the Transac S-2000. Features covered include versatility, speed, balance, compactness, installation requirements, operation and maintenance. Facts and figures are given for the central computer, on-line input/output and off-line peripheral equipment. For copy write PHILCO CORP., Government and Industrial Div., 4700 Wissahickon Ave., Philadelphia 44, Penna.

Circle 205 on Reader Service Card.

DATA HANDLING, PROCESSING SYSTEMS: A series of technical bulletins describing various custom engineered data handling and processing systems is now available. Each individual bulletin describes a specific system—system design abstracts, illustrations, major specifications, discussion of operation and accompanying block diagrams. For copies write EPSCO, INC., 588 Commonwealth Ave., Boston 15, Mass.

Circle 206 on Reader Service Card.

PROGRAMMING COMPUTERS: A code of uniform programming conventions for Univac II systems has been published. Adoption of the conventions by Univac II users will make possible smooth exchange of standard programming routines among the users. The conventions include standard formats for data and instruction files and standard operating options for Univac II routines. For copy write REMINGTON RAND UNIVAC DIV., 315 4th Ave., N. Y. 10, N. Y.

Circle 207 on Reader Service Card.

TAPE REEL: A two-page technical sheet is devoted to precision tape reels and first discusses the need for such reels. Some advantageous features itemized—interchangeability, better tape guidance and improved tape pack. Pertinent facts, including specifications, materials used, construction and available sizes, are supplemented by detailed drawings and pictures. For copy write AMPEX CORP., 934 Charter St., Redwood City, Calif.

Circle 208 on Reader Service Card.

TRANSDUCTORS: A 12-page booklet describes these high performance standard units for measurement and control. The work includes such details as where transductors are used, what they do, how they work. It also gives their electrical characteristics. Profusely illustrated with outlines and

schematic drawings, the booklet is generously sprinkled with specifications. For copy write CONTROL, a div. of Magnetics, Inc., Butler, Penna.

Circle 209 on Reader Service Card.

DIGITAL SYSTEMS: This four-page, three-color brochure provides a comprehensive account of the manufacturer's line of digital systems. Emphasis is given to the meter unit, construction, components and the transistors and stepping switches used. Explanations are also given of the functions of the master and auxiliary scanner, ac converter, control unit and the remote readout. The fourth page is devoted to full specifications of seven units. For copy write CUBIC CORP., 5575 Kearny Villa Road, San Diego 11, Calif.

Circle 210 on Reader Service Card.

MAGNETIC MEMORY: A technical paper titled "The Magnetic Memory Switch or Madget Register Storage Device," by H. J. McCreary, is now available. This paper describes a device which selects an address for the storage of data, stores the data, selects address of stored data, and reads out stored data. All this is done by magnetic marking and magnetic readout. The readout is indicated by electrical contacts on the tractively displaced detecting elements. For copy write AUTOMATIC ELECTRIC CO., Northlake, Ill.

Circle 211 on Reader Circle Card.

CURRENT PULSE AMPLIFIERS: Bulletin 57-A contains facts, specifications and an illustration of models 1070 and 1070A. These units, according to the two-page release, are noted for their high source impedance, linear and exponential rise time control, positive or negative pulses at ground level, high frequency pulse resolution, exponential fall time control and amplitude insensitive to duty factor. For copy write RESE ENGINEERING, 731 Arch St., Philadelphia 6, Penna.

Circle 212 on Reader Service Card.

BUILDING BLOCKS: Fully transistorized five megacycle digital computer circuits are described in this four-page, two-color brochure. Standard signals, logical operations and cost are covered briefly and are accompanied by illustrations and drawings. A summary of the characteristics of 10 models and four accessories is presented in chart form and a rundown of the main features of the units is included. For copy write DIGITAL EQUIPMENT CORP., Maynard, Mass

Circle 213 on Reader Service Card.

X-Y RECORDER: Catalog D-1 is distinguished by its unusual size (2 in. x 2½ in.) and its varied content. Besides containing pictures of eight models and specs of the manufacturer's line of x-y recorders, it presents the same treatment of such instruments as a curve follower adaptor, a logarithmic converter, a tape translator, card punch units and many others. The accordion-type folder has 21 "pages." For copy write F. L. MOSELEY CO., 409 N. Fair Oaks, Pasadena, Calif.

Circle 214 on Reader Service Card.

ELECTRONIC RESEARCH: Covered in this folder are the sponsors, program and scope of an endowed organization dedicated to the advancement of science through the conduct and encouragement of research in the electronics field. Individual technical sheets included in the folder, cover instrumentation and control, computational research, electronic components, systems engineering and many other subjects within the data processing field. For copy write BATTELLE MEMORIAL INSTITUTE, Columbus 1, Ohio.

Circle 215 on Reader Service Card.

HIGH SPEED TAPE READER: This six-page, fold-in type brochure provides the highlights and illustrations of types TR2 and TR3. Besides listing special features and some specifications, the release contains an account of the operational characteristics of the units. It quotes a maximum speed for the TR2 of 200 and for the TR3 of 400 characters per second. For copy write FERRANTI, LTD., 30 Rockefeller Plaza, New York 20, N. Y.

Circle 216 on Reader Service Card.

MINIATURE COMPONENTS: Catalog M-202 covers this company's complete line of miniature electronic components. Included among the items shown are miniature and sub-miniature push button switches; test clip adapters for testing resistors, capacitors and other pigtail type components; and a new series of binding posts. The complete series of miniature rotary tap switches is also described. For copy write GRAYHILL, INC., 561 Hillgrove Ave., LaGrange, Ill.

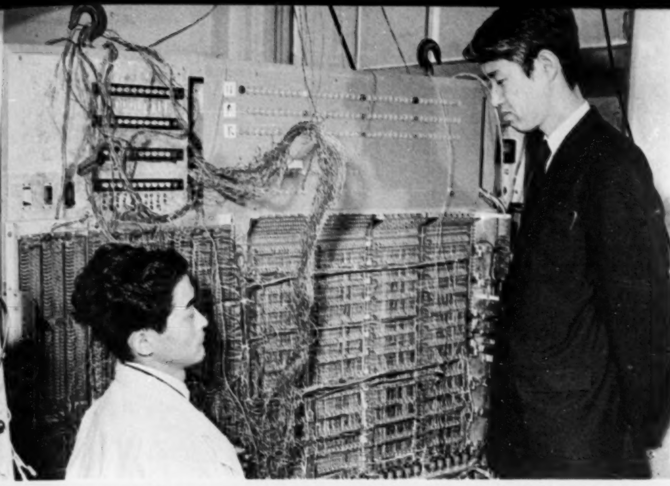
Circle 217 on Reader Service Card.

MATHEMATICAL SERVICES: This brochure describes services offered by a firm which manufactures and markets electronic equipment for high speed computation. These services consist of scientific computing, data reduction and consulting. The reader will be informed of the firm's experience in solving computation problems. A brief outline of the general services offered and a short history of the company plus thumbnail sketches of personnel are presented. For copy write COMPUTER CONTROL CO., INC., 2251 Barry Ave., Los Angeles 64, Calif.

Circle 218 on Reader Service Card.

SWITCHING CIRCUITS: "High Speed Zener Switching Circuits," an application bulletin giving detailed information on high speed electronic switching necessary for missile computers, ground control computers and industrial computers is available. It describes the operation of silicon junction diodes about the zener or "avalanche breakdown" region. This permits diode switching at speeds of many magnitudes greater than those obtainable with zero bias point switching. For copy write HOFFMAN ELECTRONICS CORP., Semiconductor Div., 930 Pitner, Evanston, Ill.

Circle 219 on Reader Service Card.



Discussing the circuitry of this parametron computer are Eiichi Goto (left), inventor of the system, and Dr. Hidetoshi Takahashi, the computer's designer. The arithmetic circuit is at left, control circuit is right, and below is the vacuum tube amplifier for the indicators.

IN JAPAN

newest computer in operation

Construction of one of the first digital computers to use new parametrons in its arithmetic and control units was completed in a Tokyo University Department of Physics laboratory and the computer is now in operation, according to Dr. Hidetoshi Takahashi, head of the laboratory.

The main feature of this computer is that it uses no transistors, diodes, or vacuum tubes in its arithmetic and control units. Instead, the model uses 3,800 parametrons, a discovery of a 27-year old Tokyo University research assistant, Eiichi Goto. The result of his work has been called Japan's most important post-war scientific development.

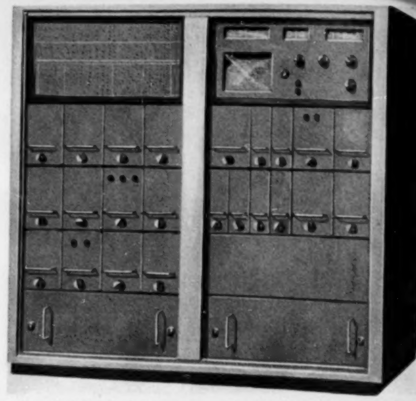
Dr. Takahashi claims that a parametron computer can be built for about one-half the cost of a conventional vacuum tube circuit computer and is well suited to a country of limited resources like Japan. Other important advantages are that tolerance is less rigid and the possibility of breakdown is remote, he says, because there are no deteriorating or consumptive parts. Other claims are that no air-conditioning is needed, as operation is not affected by normal temperature changes; and power consumption is relatively low.

In the parametron circuit a 2 megacycle alternating current input is supplied to the parametron and the phenomenon of parametric excitation causes spontaneous oscillation at 1 megacycle in the resonance circuit from which the output is taken. The selection depends on phase instead of amplitude, so that even if there is an error in the input signal approaching plus or minus 90 degrees, the output will remain constant. This permits a wide latitude to input signals, making for a greater degree of reliability than in other circuits, it is claimed.

The main drawback in the parametron system is its slow speed, between 1/10 and 1/5 of vacuum tube speed, Goto estimates. The clock cycle in the pilot model is 100 micro-seconds, but the next model will be three times as fast, and improvement up to ten times is forecast for future models. The high frequency power supply which is required is also considered a disadvantage.

Plans now under discussion call for a prototype commercial model of the parametron computer to be built at Tokyo University by a subsidiary of Fuji Electric Company, one of Japan's largest integrated electrical manufacturers and another to be built by Yurin Electric Company, which is presently operating Japan's only computer service. (See DATAmation Abroad).

BECKMAN INTRODUCES MODEL 123



One of the latest additions to the field of data processing is Model 123 data processing system developed and now available from the Systems Division of Beckman Instruments at Anaheim, California.

This system handles 100 channels of information fed by transducers measuring pressure, velocity, flow, temperature, etc. It will scan all 100 points in 60 seconds and log the information digitally on electric typewriters.

Programming of the system is accomplished by pinboard. Operations such as scaling, zero off-set and off-normal alarm are set up on pinboards, allowing a great number of programming combinations. The pinboard also lends itself well to changes in operating parameters of the variables being measured since a change in operating conditions can be easily made by changing pin locations.

The 123 system is designed entirely around solid state components. Since reliability is a prime requisite in areas of system application, every component has been selected to guarantee stability and long life to the overall system, the manufacturer states.

Applications for the 123 include chemical unit operations, refineries, reactors, power plants, airframe testing, or wherever data is to be recorded from multiple test points. The system is suited for continuous operation and includes upper and lower alarm settings for each channel to indicate off-normal conditions.

Performance	
Channel Capacity	100 (98 signals plus one self-checking plus one time designation)
Accuracy	± 0.2% of full scale ± 10 microvolts ± ½ digit digitalizing error
Scan Rate	0.55 seconds per channel
Scan Period (100 Channels)	1 minute
Input	
Signal Voltage	10 mv to 0.2 v full scale
Source to Ground	Inputs grounded or floating. Maximum signal to ground potential ± 1.0 V DC, 1.0 V AC
Scaling, Zero Offset and Off-Normal Limits	Pinboard programming. Individual programming for all 100 channels
Readout	
Word Length	4 Digits
Full Scale Digital Range	10,000
Logging	Manual—on demand. Automatic—1, 5, 10, 30, 60 or 120 minute intervals
Printing	Electric typewriter
Off-Normal Indication	Visual on all 100 channels. Audible alarm and typewriter print-out
General	
Service Requirements	115 ± 10 V 60 cycle, single phase. Input 15 amps normal
Operating Environment	65° F to 80° F
Cooling	Blower provided

Circle 105 on Reader Service Card.